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KIRSTENBOSCH, NEWLANDS
CAPE PROVINCE

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Dark green

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EIGHT NEW IRIDACEAE FROM THE CAPE PROVINCE.

(With Plates 1—3.)

By G. J. Lewis.

Babiana adpressa, Lewis. § Eu-Babiana.

B. Sprengelii, Baker, affinis sed foliis glabris vel subglabris, perianthii segmentis longioribus angustioribusque, differt.

Planta (cormo incluso) 14·5 cm. alta, parte infra terram 7 cm. long., parte superiore ad terram adpressa. *Cormus* diam. 1·5 cm., tunicis e fibris tenuibus, superne per 4·7 cm. productis, compositis. *Folia* 7, plicata, obtusa, nervis minute ciliatis, ad terram adpressa, long. ad 5·5 cm., lat. ad. 1·8 cm. *Spica* c. 8-flora, secunda. *Bractea* obtusa, pilosa, long. 3 cm., lat. 1·2 cm. *Bracteolae* conduplicatae, acuminatae, long. 2·2 cm., basi per 5 mm. coalitae. *Perianthium* pallide lilacinum luteumque ; tubo 2·1 cm. long., segmentis subaequalibus, obtusis vel subacutis, c. 3·5 cm. long., c. 7 mm. lat., 3 exterioribus minute apiculatis. *Stamina* ad tertiam vel ad dimidiam partem segmentum attingentia, filamentis 1·5 cm. long., antheris 6 mm. long. *Gynaecium* 4 cm. long., stylo fere ad apicem antherarum attingente, ovario glabro, 5 mm. long.

Hab. Cape Province, Clanwilliam Division, Nardouw Pass, July, 1933, T. M. Salter in National Botanic Gardens 1159/33 (in Bolus Herbarium).

The specific name *adpressa* has been given on account of the stem and leaves which are short and curved so that they lie flat upon the surface of the ground. It is closely allied to *B. Sprengelii*, Baker, but differs in its habit and also in having glabrous or subglabrous leaves and longer and comparatively narrower perianth-segments.

The drawings and description were made from plants which flowered in the National Botanic Gardens, Kirstenbosch, during July 1936, the

corms having been collected and presented by Paymaster-Captain T. M. Salter in 1933. (Plate 1.)

Description.—Plant (corm included) 14·5 cm. high ; portion below ground 7 cm. long, upper portion curved and adpressed to ground. *Corm* 1·5 cm. diam., tunics very thin, extending upwards to form a " neck " 4·7 cm. long. *Leaves* 7, all curved towards ground, plicate, obtuse, minutely ciliate on veins, up to 5·5 cm. long, up to 1·8 cm. broad. *Spike* 8-flowered, secund. *Bract* obtuse, pilose, 3 cm. long, 1·2 cm. broad. *Bracteoles* conduplicate, acuminate, 2·2 cm. long, fused for 5 mm. at base. *Flowers* pale mauve and yellow ; perianth-tube 2·1 cm. long ; segments subequal, about 3·5 cm. long, about 7 mm. broad, 3 outer minutely apiculate. *Stamens* reaching about one-third or half-way up segments ; filaments 1·5 cm. long, anthers 6 mm. long. *Gynaecium* 4 cm. long, style reaching to top of anthers ; ovary glabrous, 5 mm. long.

Babiana crispa, Lewis. § Eu-Babiana.

B. plicata, Ker, affinis sed laminis foliorum crispulatis undulatisque vix plicatis differt.

Planta (cormo incluso) 27 cm. alta. *Cormus* parvus, anguste ovoideus, 7 mm. diam., tunicis e fibris tenuibus compositis. *Caulis* simplex, parte supra terram brevissimus. *Folia* 6 vel 8, diffusa vel suberecta ; lamina plicata sed marginibus crispulatis undulatisque, spiraliter torta, acuminata, pilis mollis vestitis, 3·5 ad 13 cm. long. supra terram, lat. ad 6 mm. *Inflorescentia* 2—4-flora. *Bractea* herbacea, parce pilosa, apice brunnea, acuminata, 3 cm. long., lat. ad 9 mm. *Bracteolae* parum ultra dimidium coalitae, acuminatae, 2·5 cm. long. *Perianthium* pallide lilacinum 4·6—5·5 cm. long., tubo 1·4—2 cm. long. ; segmenta marginibus leviter undulatis, exteriora obtusa, minute apiculata, interiora acuta ; 3 superiora 2·5—3 cm. long, lat. ad 1 cm. ; 3 inferiora parum breviora, 2 lateralibus pro parte majore pallide luteis, inferne linea purpurea 3-flexa notatis. *Stamina* arcuata, parum ultra dimidium segmenti attingentia. *Stylus* antheras leviter superans. *Ovarium* glabrum.

Hab. Cape Province, Clanwilliam Division, 2 miles north of Langekraal along the Clanwilliam to Doornbosch road, July 1933, P. Ross-Frames, Bolus Herbarium 20837, type ! ; Pakhuis Pass, Mrs. J. Bergh, B.H. 21399 ; road from Pakhuis to Wupperthal, Dr. C. L. Leipoldt, B.H. 20774 ; Langekraal, T. M. Salter in National Botanic Gardens 1158/33.

This attractive and very distinct Babiana was first discovered by Mr. P. Ross-Frames in 1933 and was grown in his garden at Kenilworth,

PLATE 2. *Babiana crispa*. 1. Bract. 2. Bracteoles. 3. Flower, front view. 4. Flower, longitudinal section ; all natural size. (*Del.* G. J. Lewis.)

PLATE 1. *Babiana adpressa.* 1, Bract. 2, Bracteoles. 3, Flower, front view. 4, Flower, longitudinal section; all natural size. 5, Style branches, × 3. (*Del.* G. J. Lewis.)

where it flowered in 1935 and again in July 1937, when the drawings and description were made from living plants kindly presented by him to the Bolus Herbarium. Three separate collectors have sent material of this species to the Bolus Herbarium since then, and the corms given to the National Botanic Gardens by Paymaster-Captain T. M. Salter flowered at Kirstenbosch during June and July 1937. The corms are small and very difficult to obtain, as they grow in rock crevices usually very tightly wedged and extending down to a considerable depth below the surface.

This species is allied to *B. plicata*, Ker, but differs from that and all other species in the genus in having undulate and crisped margins to the leaves. (Plate 2.)

Description.—Plant (including corm) 27 cm. high. *Corm* very small, elongated, 7 mm. diam.; tunics of very fine fibres. The flower-bearing corm is usually surrounded by 2 or 3 young corms forming a compact cluster. *Stem* simple, part above ground very short, overtopped by leaves. *Leaves* 6 or 8 to a plant, spreading or sub-erect, scarcely plicate but with margins crisped and undulate, twisting spirally, acuminate, bearing fine, silky hairs, 3·5—13 cm. long (above ground), up to 6 mm. broad. *Spike* 2—4-flowered. *Bract* slightly pubescent, acuminate, the apex brown, 3 cm. long, 8—9 mm. broad. *Bracteoles* fused except apex, which is free, acuminate, 2·5 cm. long. *Flowers* 4·6—5·5 cm. long; perianth-tube 1·4—2 cm. long; 3 upper segments pale mauve, 2·5—3 cm. long, up to 1 cm. broad; 3 lower segments slightly shorter, the 2 inner ones yellow in lower half with a deep mauve W-shaped mark at the base; 3 outer segments obtuse, minutely apiculate; 3 inner acute. *Stamens* arcuate reaching half-way up segments. *Style branches* overtopping stamens. *Ovary* glabrous.

Babiana erectifolia, Lewis. § Acaste.

B. stricta, Ker var. *angustifolia*, Sweet affinis sed foliis erectis, firmis, minute ciliatis, acuminatioribus, bene plicatis, differt.

Planta (cormo incluso) 22—25 cm. alta. *Cormus* parvus, 1·4 cm. diam.; tunicis e fibris sat robustis, parallelis, superne per 7·5 cm. productis, compositis. *Caulis* gracilis, erectus, minute pubescens, vel folia leviter superans vel parum ultra dimidium foliorum attingens. *Folia* 6 vel 7, linearia, erecta, textura firma, acuminata, nervis minute ciliatis, 4—13 cm. long., 1·5—5 mm. lat. *Spica* sat densa, 3—9-flora. *Bractea* minute pilosa, obtusa, aliquando minute apiculata, 15—8 mm. long, 5—4 mm. lat. *Bracteolae* liberae, acuminatae, 14—6 mm. long. *Flores* aequilaterales; perianthii tubus 1·2 cm. long.; segmenta interiora oblonga, obtusa, pallide albo-lilacina, 2·1 cm. long., 9—12 mm. lat.;

exteriora lilacina, 2·1 cm. long., 8—10 mm. lat. *Stamina* aequilateralia, antheris 6 mm. long., 1—2 mm. lat. *Stylus* antheras aequans vel leviter superans. *Ovarium* pubescens.

Hab. Cape Province, Worcester Division, near Brand Vlei, in damp ground, September 1932, G. J. Lewis in National Botanic Gardens 2686/32, type ! (in Bolus Herbarium) ; near Worcester, Dr. C. L. Leipoldt, Bolus Herbarium 18559. Robertson Division, Boschjesmans Rivier, G. J. Lewis, Bolus Herbarium 22170.

The drawings and description are made from plants which flowered in the National Botanic Gardens, Kirstenbosch, during August, 1936. This species is closely allied to *B. stricta*, Ker var. *angustifolia*, Sweet, but differs in having more acuminate, erect and nearly glabrous leaves which are firm in texture. Like *B. stricta*, it is one of the more graceful species with a fairly long peduncle above the ground. (Plate 3.)

Description.—Plant (including corm) 22—25 cm. high. *Corm* small, 1·4 cm. diam. ; tunics composed of fairly strong, parallel fibres extending upwards to form a neck 7·5 cm. long. *Stem* slender, erect, seldom branched, equal to or overtopping leaves or sometimes reaching just over half-way up leaves. *Leaves* narrow, linear, acuminate, firmly plicate and firm in texture, erect, minutely ciliate on veins, 4—13 cm. long, 1·5—5 mm. broad. *Spike* 3—9-flowered, fairly dense. *Bract* minutely pubescent, obtuse, sometimes minutely apiculate, 15—8 mm. long, 5—4 mm. broad. *Bracteoles* free, acuminate, 14—6 mm. long. *Flowers* regular ; perianth-tube 1·2 cm. long ; 3 inner segments oblong, obtuse, pale creamy-mauve, the 2 lower segments having 2 small, dark mauve marks at their base, 2·1 cm. long, 9—12 mm. broad ; 3 outer segments mauve, as long as inner segments, 8—10 mm. broad. (In wild specimens the perianth-segments are slightly shorter and narrower than in the Kirstenbosch-grown plants described above.) *Stamens* equilateral ; anthers 6 mm. long, 1—2 mm. broad. *Style* as long as or just overtopping anthers, the branches flattened and slightly crenulate at the tips. *Ovary* pubescent.

Galaxia citrina, Lewis.

G. graminea, Thunb. affinis sed floribus majoribus perianthii segmentis longioribus angustioribusque differt.

Planta 8 cm. alta (cormo et flore inclusis). *Cormus* ovoideus, 1·3 cm. diam., tunicis rugosis, rigidis, ligneis. *Folia* omnino glabra, linearia, nitida, long. ad 7 cm., lat. ad 4·5 mm. *Spatha* foliis similis, long. ad 4 cm., 3 mm. lat. *Bractea* superne herbacea sed infra membranacea sine pigmento, 2·1 cm. long., 8 mm. lat. *Flores* diam. ad 5 cm. ; perianthii tubus 2·8 cm. long. ; segmenta ex-

PLATE 3. *Babiana erectifolia*. 1. Portion of leaf × 3. 2—7 All natural size. 2. Bract. 3. Bracteoles. 4. Flower. 5. Flower, longitudinal section. 6. Outer perianth-segment. 7. Inner perianth-segment. (*Del.* G. J. Lewis.)

teriora 2·9 cm. long., 1·1 cm. lat., interiora 2·9 cm. long., 9 mm. lat., citrina, dorso atro-brunneo tincto. *Stamina* basi segmentis adnata ; filamenta connata, 6 mm. long.

Hab. Cape Province, Clanwilliam Division, Cold Bokkeveld, between de Keur and top of Gydo Pass, B. Martin in National Botanic Gardens 2073/36 (in Bolus Herbarium).

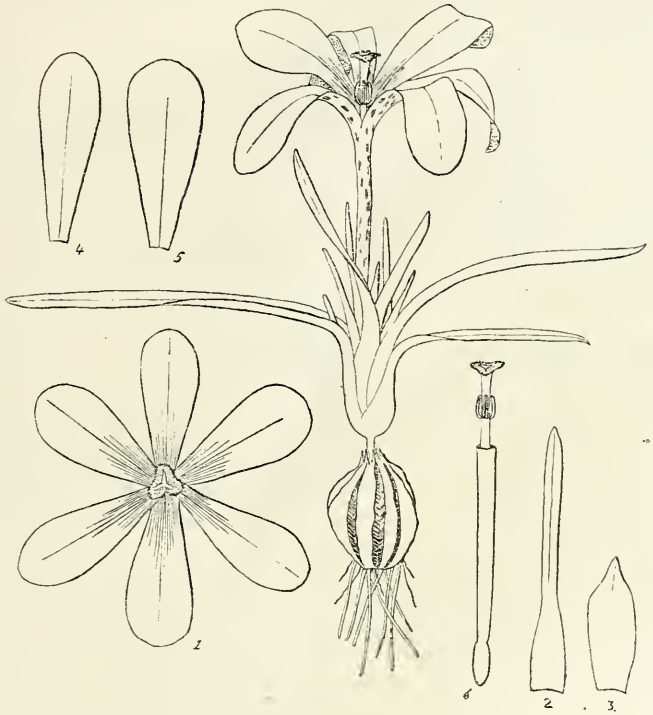

Fig. 1. *Galaxia citrina.* 1. Flower. 2. Spathe. 3. Bract. 4. Outer perianth-segment. 5. Inner perianth-segment. 6. Androecium, gynaecium and perianth-tube. All natural size.

The genus Galaxia is a very small one, consisting in the Flora Capensis of only two described species and four varieties. An interesting feature of the genus is the fact that although each plant gives rise usually to only one flower at a time, the flowers on all the plants open on the same day. The flowers are extremely fugitive and remain open for less than

a day, so that until the next buds open three or four days later, with the exception of one or two odd flowers, the plants remain inconspicuous until the massed brightness of the flowers attracts one's attention again.

The present species, with its bright lemon-coloured flowers, flowered freely in the National Botanic Gardens, Kirstenbosch, during July and August, 1937. It is closely related to *G. graminea*, Thunb., but differs in having very much larger flowers with comparatively longer and narrower perianth-segments. (Text-fig. 1.)

Description :—Plant 8 cm. high, including corm and flower. *Corm* ovoid, 1·3 cm. diam. ; tunics woody, hard and ridged. *Leaves* smooth, shiny, entirely glabrous, up to 7 cm. long, 4·5 mm. broad. *Spathe* exactly resembling leaves, up to 4 cm. long, 3 mm. broad. *Bract* herbaceous above, membranous and colourless below, 2·1 cm. long, 8 mm. broad. *Flowers* up to 5 cm. diam. when expanded ; perianth-tube 2·8 cm. long ; outer segments 2·9 cm. long, 1·1 cm. broad ; inner segments 2·9 cm. long, 9 mm. broad, all clear, bright lemon-yellow above, streaked with dark brown on the lower surface. *Stamens* attached to the base of the segments ; filaments fused, 6 mm. long.

Galaxia variabilis, Lewis.

G. graminea, Thunb. affinis sed foliis latioribus minus acuminatis marginibus minute pilosis differt.

Planta (cormo incluso) ad 7·5 cm. alta. *Cormus* globosus, 1·2 cm. diam. : tunicis infra paucis crassis rigidis, supra reticulatis mollioribus compositis. *Folia* linearia, obtusa vel subobtusa, leviter conduplicata, marginibus minute pilosis, 3—5·5 cm. long., lat. ad 6 mm. *Spatha* foliis similis, basi membranacea, 4·2 cm. long. *Bractea* dimidio inferiore membranacea, 2·3 cm. long., 8 mm. lat. *Perianthii tubus* 1·7—2 cm. long., 1·5 mm. diam. *Flores* roseo-lilacini, basi lutei, aliquando lutei vel albi ; segmenta exteriora oblonga, superne rotunda, aliquando leviter emarginata, 2·4 cm. long., 1·2 cm. lat., interiora 2·4 cm. long., superne 1·1 cm. lat., infra unguiculata. *Stamina* filamentiis connatis, 6 mm. long ; antheris 3 mm. long. *Stylus* antheras leviter superans, 2·8 cm. long., stigmatis lobis late diffusis cristatis ciliatisque. *Ovarium* 1 cm. long.

Hab. Cape Province, Clanwilliam Division, Cold Bokkeveld, between de Keur and top of Gydo Pass, Prof. R. H. Compton and Party in National Botanic Gardens 2080/36 (in Bolus Herbarium.)

The specific name "*variabilis*" is given to this Galaxia because, at first sight, the flowers very closely resemble those of *Oxalis variabilis* and like those of *O. variabilis* they vary in colour. Usually the flowers are a soft mauve-pink above, yellow at the throat and with a band of magenta

where the two colours meet. Some flowers were found without this deeper band of colour, some salmon-pink and yellow and occasional pure white and pure yellow flowers as well.

Fig. 2. *Galaxia variabilis.* 1. Flower. 2. Bract. 3. Outer perianth-segment. 4. Inner perianth-segment. 5. Androecium and gynaecium; all natural size. 6. Androecium and stigma × 3.

The plants made a beautiful show of colour on the Cold Bokkeveld in September, 1936, when corms were collected and all the corms planted in the National Botanic Gardens, Kirstenbosch, flowered during August and September, 1937.

This species is nearest to *G. graminea*, Thunb. but differs in having broader and less acuminate leaves which are minutely ciliate on the margins. (Text-fig. 2.)

Description :—Plant (including corm) up to 7·5 cm. high. *Corm* globose, 1·2 cm. diam. ; tunics few, the lower part composed of thick, very hard, coarse fibres, the upper part a net-work of finer fibres. *Leaves* linear, obtuse or subobtuse, slightly conduplicate, very minutely ciliate on margins, 3—5·5 cm. long, up to 6 mm. broad. *Spathe* similar to leaves, membranous at base only, 4·2 cm. long. *Bract* membranous in lower half, 2·3 cm. long, 8 mm. broad. *Perianth-tube* 1·7—2 cm. long, 1·5 mm. diam. ; outer segments oblong, rounded at apex, sometimes slightly emarginate, 2·4 cm. long, 1·2 cm. broad ; inner segments 2·4 cm. long, 1·1 cm. broad in upper half, tapering below. *Stamens* with filaments fused, 6 mm. long ; anthers 3 mm. long, spreading at apex. *Style* just overtopping anthers, 2·8 cm. long ; style branches ciliate and crested. *Ovary* 1 cm. long.

Romulea aquatica, Lewis.

Folio uno producto, cormo sub aqua submerso bene distinguitur.

Planta 28—43 cm. alta. *Cormus* oblongus-ovoideus, 1·5 cm. diam., tunicis rigidis, atro-brunneis. *Vaginae basales* 3, 1—2, 3—5 et 6—15 cm. long. *Folium* unicum, teres, angustissimum, erectum, multo pedunculum superans, 33—42 cm. long., 1—1·5 mm. diam. *Pedunculus* 15—27 cm. altus. *Inflorescentia* cymosa, 1—5-flora, a bracteis 2 vaginatis, 6 et 2·5 cm. long., subtectis. *Bractea* herbacea, acuta, 8 mm. long., 4 mm. lat. *Bracteolae* herbaceae sed marginibus membranaceis albis, 8 mm. long., 4 mm. lat. *Flores* superne albi, infra lutei ; perianthii tubus 4 mm. long. ; segmenta exteriora subacuta vel acuta, 1·4 cm. long., 6—7 mm. lat. ; segmenta interiora orbiculata, 1·3 cm. long., lat. ad 9 mm. *Stamina* brevissima ; filamenta 2·5 mm. long. : antherae 3 mm. long. *Stylus* 3·5 mm. long., ramis recurvatis 1·5 mm. long. *Ovarium* glabrum, 2 mm. diam. *Fructus* grandis, orbiculatus, diam. ad 9 mm.

Hab. Cape Province, Malmesbury Division, between Hopefield and Moorreesburg in a clayey, seasonal pool, Sept., 1933, T. M. Salter 3880 ; same locality, Sept. 1937, J. W. Mathews, Bolus Herbarium 22169 ; Piquetberg Division, Elands Vlei, north of Piquetberg, in same type of pool, Sept. 1937, W. F. Barker 190.

Two important factors distinguish this Romulea from the other members of the genus. One is the single leaf which is very long and slender and the second is its habitat. Although many species favour damp, swampy ground this appears to be the only one which actually grows with its corm and lower part of the stem submerged in water.

After flowering the pedicel appears to elongate, the weight of the large capsules making it pendulous, so that the ripe fruits are frequently submerged in water as well.

Description :—Plant 28—43 cm. high. *Corm* oblong-ovoid, 1·5 cm. diam. ; tunics hard, dark brown. *Basal sheaths* 3, 1—2 cm., 3—5 cm. and 6—15 cm. long. *Leaf* 1, very slender, terete, erect, sheathing stem in lower third, much longer than peduncle, 33—42 cm. long, 1·5 mm. diam. *Peduncle* 15—27 cm. long. *Inflorescence* cymose, 1—5-flowered, subtended by 2 spathes 6 and 2·5 cm. long. *Pedicels* 1—2·5 cm. long *Bract* green and herbaceous, acute, 8 mm. long, 4 mm. broad. *Bracteoles* green and herbaceous in centre, the margins white and membranous, 8 mm. long, 4 mm. broad. *Flowers* white with a yellow throat. *Perianth-tube* 4 mm. long ; outer segments subacute or acute, 1·4 cm. long, 6—7 mm. broad ; inner segments orbicular, narrowing to a claw at the base, 1·3 cm. long, up to 9 mm. broad. *Stamens* very short ; filaments 2·5 mm. long ; anthers 3 mm. long. *Style* 3·5 mm. long ; style branches recurved, 1·5 mm. long. *Ovary* 2 mm. diam. *Fruit* a large, rounded capsule, 9 mm. diam.

Ixia splendida, Lewis. § Hyalis.

I. paniculata, Delaroche affinis sed perianthii tubo breviore dimidio superne dilatato, antheris tubo perianthii nullo modo exsertis, differt.

Planta gracillima, simplex, 33—71 cm. alta. *Cormus* c. 1·5 cm. diam. ; tunicis mollis, reticulatis. *Vaginae basales* 3, ad 9 cm. long. *Folia* basalia 3, anguste linearia, 18—39 cm. long., 2·5—5 mm. lat. ; caulina 1 vel 2. *Spica* sat densa, 5—9-flora. *Bractea* brunnea, membranacea, apice obtuso, tricuspidato, 7 mm. long. *Bracteolae* bracteas similes. *Flores* erecti vel suberecti, pallide rosei, concolores ; perianthii tubus 2 cm. long., basi 1 mm. diam., versus apicem gradatim ad 3 mm. diam. dilatatus ; segmenta apice orbiculata aliquando leviter bilobata, 1·7 cm. long., 6—7 mm. lat. *Stamina* in tubo perianthii inserta ; antherae segmentorum basi attingentes, luteae, 6 mm. long. *Stylus* dimidio antherarum attingens, ramis brevissimis.

Hab. Cape Province, Piquetberg Division, Zebra Kop, near stream on west slope of hill south of and next to Zebra Kop, Nov. 1934, N. S. Pillans 7183 (in Bolus Herbarium).

As the name implies, this is one of the most beautiful of the Ixias, having long-tubed, delicate rose-pink flowers. It is nearest *I. paniculata,* Delaroche but differs in having an unbranched stem and a shorter perianth-tube which dilates in the upper half. The anthers are not exserted at all from the throat of the perianth-tube.

Description :—Plant very slender, unbranched, 33—71 cm. high. *Corm* about 1·5 cm. diam. ; tunics soft, netted. *Basal sheaths* 3, up to 9 cm. long. *Leaves* 3 basal, narrow, linear, 18—39 cm. long, 2·5—5 mm. broad ; 1 or 2 cauline, varying in length. *Spike* fairly dense, 5—9-flowered. *Bract* brown and membranous, apex obtuse, tricuspidate, 7 mm. long. *Bracteoles* similar to bract. *Flowers* erect or suberect, pale rose-pink, concolorous ; perianth-tube 2·8 cm. long, dilating gradually from 1 mm. diam. at base to 3 mm. diam. at throat ; segments rounded or sometimes slightly bilobate at apex, 1·7 cm. long, 6—7 mm. broad. *Stamens* inserted in perianth-tube ; anthers just reaching to base of segments, yellow, 6 mm. long. *Style* reaching half-way up anthers ; style branches very short.

Ixia Bolusii, Lewis. § Hyalis.

I. paniculata, Delaroche et *I. paucifolia,* Lewis affinis sed a priore cormo majore tunicis crassioribus, caule plerumque simplice, foliis 3 marginibus incrassatis, perianthii tubo breviore, a posteriore planta altiore foliis erectis vel suberectis marginibus incrassatis, cormi tunicis minus crebris, basibus foliorum mortuum superne productis, differt.

Planta caule plerumque simplice, 38—55 cm. alta. *Cormus* 2·5 cm. diam., tunicis copiosis, e fibris crassis intertextis compositis, basibus foliorum mortuum superne 3—5 cm. productis. *Folia* 2 basalia producta, textura firma, nervis sat prominentibus marginibus incrassatis, erecta, 20—47 cm. long., lat. ad 1·1 cm. ; caulinum 1, parte libera brevissima. *Spica* sat laxa, 4—6-flora. *Bractea* membranacea sine pigmento, apice mucronulato, c. 7 mm. long. *Bracteolae* bracteas similes, 8 mm. long. *Perianthii tubus* 3—3·5 cm. long., basi ·5 mm. diam., sursum versus apice gradatim ad 1·5 mm. diam. dilatatus ; *segmenta* 1—1·3 cm. long., 4—5 mm. lat., alba, concolora. *Stamina* filamentis apice tubo perianthii attingentiis, antheris exsertis. *Stylus* apice antheris attingens, ramis brevissimis.

Hab. Cape Province, Worcester Division, Hex River Valley, near De Doorns, Oct. 1907, Dr. H. Bolus, Bolus Herbarium No. 13197.

This is an interesting species forming a link between *I. paniculata* and *I. paucifolia.* It is really more closely allied to the latter species but differs in being much taller, the leaves erect or suberect with thickened margins, and in the corm which has strong, wiry fibres, not as thick as in *I. paucifolia,* and the dead remains of leaves extending upwards to form a neck. From *I. paniculata* it differs in the larger corm with thicker tunics ; the stem is usually simple ; there are only 3 leaves which are broader, more strongly ribbed and with thickened margins ; the bracteoles are slightly longer than the bracts and the perianth-segments are

shorter and comparatively broader. The flowers are cream or white, concolorous.

Description :—Plant 38—55 cm. high ; stem usually simple, occasionally branched. *Corm* 2·5 cm. diam. ; tunics numerous, of thick, interwoven fibres ; neck of dead leaf remains 3—5 cm. long. *Leaves* 2 basal, firm, the margins thickened, veins fairly prominent, erect, 20—47 cm. long, up to 1·1 cm. broad : 1 cauline, sheathing most of stem. *Spike* fairly lax, 4—6-flowered. *Bract* colourless, membranous, minutely cuspidate at apex, about 7 mm. long. *Bracteoles* similar to bract, 8 mm. long. *Perianth-tube* 3—3·5 cm. long, ·5 mm. diam. at base, widening very gradually up to 1·5 mm. diam. at throat. *Perianth-segments* 1—1·3 cm. long, 4—5 mm. broad. *Stamens* with filaments reaching to top of perianth-tube, anthers exserted. *Style* reaching to top of anthers, branches very short.

PLANTAE NOVAE AFRICANAE.

"Ex Africa semper aliquid novi."—*Pliny.*

Series IX.

By Paymaster-Captain T. M. Salter, R.N. (Ret.).

Oxalis Creaseyi, Salter (Oxalidaceae). § Lineares.

Planta pusilla sericea, 3—4 cm. alta, caule breviter exserto. *Bulbus* anguste ovoideus, apice attenuatus, ad 1·5 cm. longus, tunicis exterioribus papyraceis, brunneis. *Rhizoma* 4—6 cm. longum, squamatum. *Bulbilli* stolonum apicibus inverse positi. *Caulis* erectus, sericeus, 0·5—1 cm. longus, squamis paucis ovatis amplexicaulibus, ad 5 mm. longis, instructus. *Folia* ad caulis apicem dense imbricantia: petioli ad 6 mm. longi, exteriores subsquamiformes: foliola 3, sessilia, linearia, conduplicativo-involuta, 0·6—1 cm. longa, glauca, supra glabra, inconspicue calloso-punctata, infra adpresse sericea, ciliata, apice subacuta, manifeste cano-penicillata. *Pedunculi* uniflori, e foliorum exteriorum axillis exorientes, 3—7 mm. longi, sparse sericei, bracteis 2 linearibus, rubro-callosis, calycem imbricantibus. *Sepala* lanceolata 4—5 mm. longa, sparse pilosa, penicillata, anguste purpureo-marginata, rubro-callosa. *Corolla* fere 1·8 cm. longa, alba, tubo infundibuliforme pallide luteo: petala e basi cuneate unguiculata obovata, antice subrotundata, ad marginem anteriorem minute rubro-callosa. *Filamenta* glabra (parte connata inclusa) minora 3—7 mm., majora 6—9 mm. longa, edentata. *Ovarium* 1·5 mm. longum in dimidio superiore cano-pubescens, loculis 2-ovulatis, stylis glabris.

Hab. Namaqualand: Leliefontein district, 22 miles north-east of Garies, at the base of a rock outcrop, *Salter* 6680 (*type* in Bolus Herbarium). Flowers June.

This small species has been named in honour of my companion Mr. L. B. Creasey, who assisted me in obtaining bulbs for cultivation. It seems to be nearest in affinity to *O. furcillata*, Salter, which, however, has bifurcate leaflets. It may be recognised by its dwarf habit, greyish silky linear involute leaflets, which, like the sepals, are conspicuously albo-penicillate, and very short peduncles.

The system of vegetative reproduction is by underground stolons or "droppers" arising both from the rhizome and from near the base

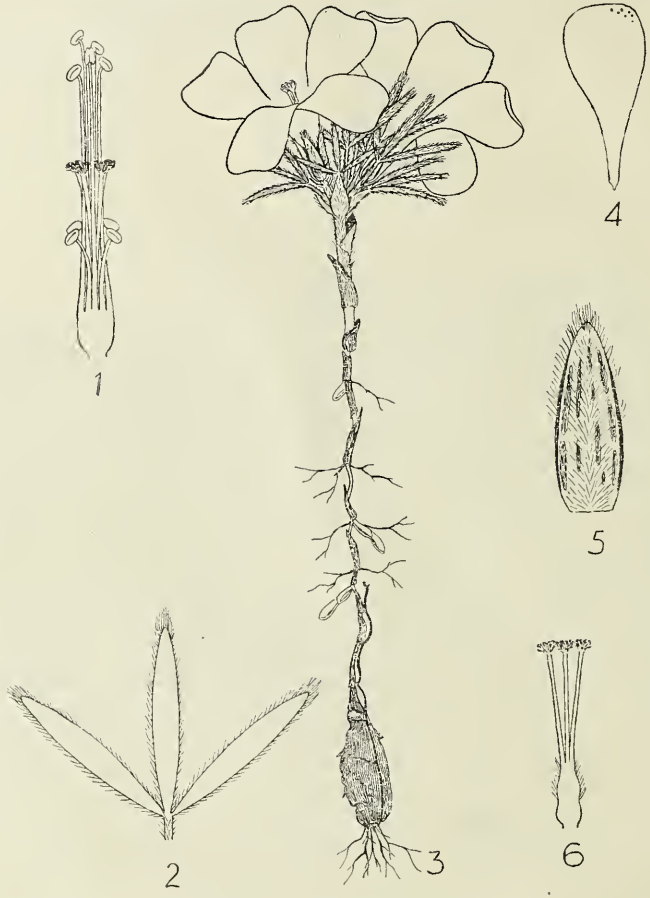

Fig. 1. *Oxalis Creaseyi* Salter. 1. Androecium × 5. 2. Leaf, upper side × 3. 3. Plant × 1½. 4. Petal × 1½. 5. Sepal × 6. 6. Gynaecium × 5. (*Salter* 6680.) *Del.* T. M. Salter.

of the bulb and differs from that of all other South African Oxalis hitherto observed in that a protective tube is formed for the delicate ascending axis from the new bulbils. The bulbs, once they are formed at the ends

of the droppers, are normal in their development and though their life appears to be comparatively short, it is at least 2 to 3 years.

Fig. 2A represents the root system about 3 months after flowering. Fig. 2B shows a simple diagram of the vertical structure of a bulb, the

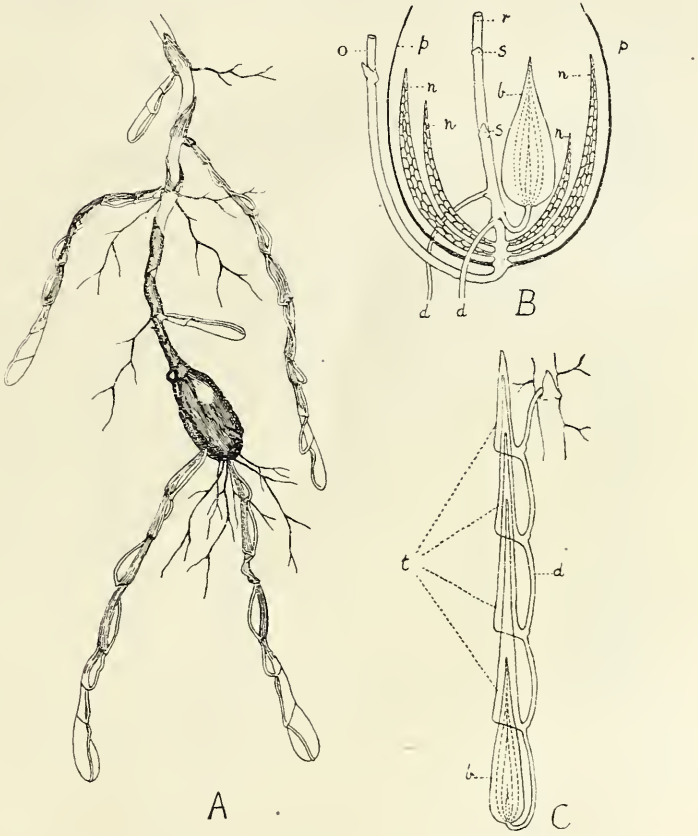

Fig. 2. The system of vegetative reproduction in *Oxalis Creaseyi*, Salter. A. Underground structure × 1½. B. Diagram of vertical section of the bulb, the parts slightly separated: *o.* withered dropper; *r.* current year's rhizome; *p.p.* layer of thin protective scales; *n.n.* exhausted nutritive scales of the current year; *d.d.* droppers; *b.* following year's bulb; *s.s.* small scales. C. Diagram showing the formation of the protective tube: *d.* dropper; *b.* bulbil; *t.* the calyptrate scales forming the tube. *Del.* T. M. Salter.

parts having been slightly separated. The bulb consists of an ascending axis (rhizome) *r*, bearing on its lower part the now exhausted nutritive scales *n*, *n* of the current year and on its upper part, within the bulb some very small scales *s*, *s*. Just above the nutritive scales are also a few undeveloped scales, one of which produces, as an axillary structure, the new or next year's bulb *b* : the others produce, each in its axil, a dropper *d*, *d*.

Above the old bulb droppers are also produced in the axils of the scales of the rhizome, i.e. on the underground portion of the stem between the apex of the bulb and the base of the aerial shoot, as shown in Fig. 2A. In the illustration of the living plant (Fig. 1) it will be seen that the upper droppers have just commenced to develop.

Each dropper is an axis which descends with the growing apex reversed, forcing down the young white bulbil which forms its apex base-first. The striking peculiarity is that from the nodes of the dropper are produced the calyptrate outer protective scales of the bulbil, one at each node and, with the downward lengthening of the internodes, these scales slip off the apex of the bulbil and are left behind in succession, deeply imbricating one another in the form of a tube (Fig. 2C.) At first the scales are very thin, white and soft, but as they receive independent nutriment from the dropper they become stouter and more leathery, soon turning brown in colour. When it reaches its final position the new bulbil *b* begins to swell rapidly and form a new bulb. The scaly tube *t*, which has been formed above it, evidently provides a protective channel for the ascending axis which it will subsequently produce, indeed, part of this tube, still attached to the previous year's dropper, can be seen on the rhizome immediately above the old bulb in Figs. 1 and 2A.

It is probable that the new shoots do not follow these channels in their entirety, but burst through them when strong enough, otherwise they would become inconveniently crowded and matted together. This congestion actually does not occur in the field, although the plants were growing fairly thickly.

Oxalis xerophila, Salter (Oxalidaceae). § Lineares.

Planta gracilis, caule exserto, 3—6 cm. alta. *Bulbus* late subuloideus in parte inferiore amplians, tunicis papyraceis imbricantibus brunneis. *Rhizoma* saepe 12 cm. longum, squamis amplexicaulibus praecipue ad apicem indutum. *Partes herbaceae* breviter pubescentes. *Caulis* gracilis, squamis vel foliis paucis parvis instructus. *Folia* 8—20, caulis apice aggregata, interdum 1—2 caulina : petioli filiformes, ad 2 cm. longi, exteriores et caulini breviores vel saepe squamiformes : foliola 3,

sessilia, lineari-oblonga vel angustissime elliptica, ad basin subcuneate angustata, minute emarginata, plus minusve conduplicativa, leviter falcata, supra glabra, eciliata. *Pedunculi* 1—4, uniflori, vix 1 cm. longi, prope apicem bibracteati: bracteae parvae, subulatae, alternantes, sicut sepala rubescentes. *Sepala* late lanceolata, ciliata, ad apicem nigrescentia. *Corolla* 1·6—2·2 cm. longa, lilacea, tubo cylindrico

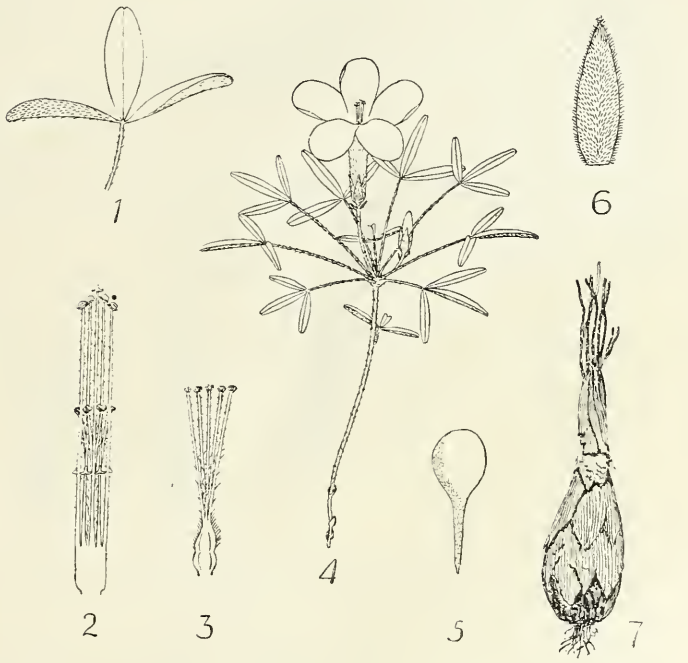

Fig. 3. *Oxalis xerophila* Salter. 1. Leaf × 2. 2. Androecium × 3. 3. Gynaecium × 3. 4. Plant, natural size. 5. Petal, natural size. 6. Sepal × 5. 7. Bulb, natural size. (*Salter* 4455.) *Del.* T. M. Salter.

pubescente luteo, quam laminae parum longiore: petala e basi anguste unguiculata obovata, vel anguste obovata, 4—8 mm. lata, margine exteriore minute pubescentia et obscure pallideque viridia. *Filamenta* exteriora glabra, interiora minute glandulosa, longissima ad 1·5 cm. longa, e corollae tubo valde exserta. *Ovarium* oblongum, ad 2 mm. longum, in dimidio superiore pubescens, stylis inferne sparse pubescentibus, superne minute glandulosis. *Capsula* globosa, loculis 2-ovulatis.

Hab. Cape Province: Calvinia Div.; 1 mile north of Calvinia, *Salter* 4468 (*type* in Bolus Herbarium); 22 miles north of Downes Station, 4455. Flowers May.

This species falls into the same section as *O. linearis*, Jacq. and *O. arcuata*, Jacq., the latter species being only known from Jacquin's cultivated specimen of unknown origin. This section is characterised principally by the rather long cylindrical hairy corolla tube. *O. xerophila* differs from the former (a rather roughly hirsute plant) in its soft minute pubescence and in the shape of the leaflets, and from the latter (in which, *fide* Jacquin, the stamens are barely exserted from the tube), in having markedly protruding stamens (or styles) and from both these species in its elongate bulb.

Fig 3 has been drawn from a plant cultivated from bulbs of *Salter* 4455 and, as is often the case in cultivation, the specimen is rather longer in all parts than the average wild specimens, which struggle for existence in the arid country around Calvinia. (v.v.s., v.v.c).

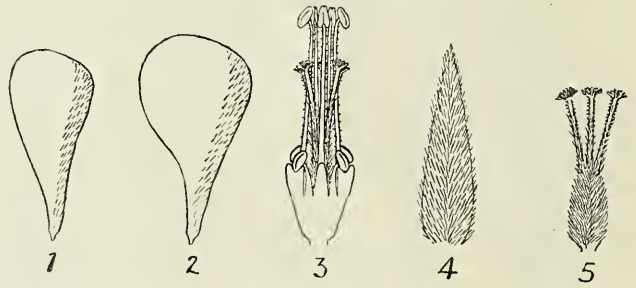

Fig. 4. *Oxalis lanata* L.f. (white) petal × 1½. 2. *O. lanata*, var. *rosea* petal × 1½. 3. Androecium × 5. 4. Sepal × 5. 5. Gynaecium × 5. *Del.* T. M. Salter.

Oxalis lanata, L.f., var. **rosea,** Salter (Oxalidaceae). § Obcordatae.

Var. nov. A forma typica ita differt: *Petala* rosea, latiora, e basi distincte unguiculata, superne obovata, 1·5—3 cm. longa. *Foliorum* color viridis leviter obscurior. *Ovarium* 3—5-ovulatis.

Hab. Cape Province: Cape Peninsula; Wynberg Hill near Kirstenbosch, *Salter* 992, *F. Bolus*, Bol. Herb. 22159 (*type*): Somerset West Div.; Sir Lowry Pass, *Salter* 3289, *Schlechter* 4802 (erroneously attributed by R. Knuth to *O. truncatula*, Jacq.). Steenbras, *Salter* 4743: Caledon Div.; French Hoek Pass, *Salter* 6214, *Leipoldt*, Bol. Herb. 22160: Worcester Div.; Bain's Kloof, *Salter* 4777, 6833; Paarl Div.; Bushman's Castle, *Salter* 6888, 6889: Tulbagh Div.; Tulbagh Road Station, *Guthrie* 2021, Artois, *Bolus* 7577. Flowers May—Oct. (usually Aug.—Oct.).

In this variety, in addition to the rose-red corolla, the petals are unguiculate in the lower half and wider above than those of the typical white-flowered form which are almost cuneate in shape (Fig. 4.). The bulb is ovoid (or in some mountain forms narrow-ovoid), beaked at the apex with more or less lanate tunics. The two forms have only once been observed growing in association.

Oxalis lanata, L.f. with virescent flowers.

This curious teratological variety (Fig. 5), which has leaf-like sepals and petals, occurs in great abundance in a plantation bordering on the Kirstenbosch estate near the Bolus Herbarium, but it is limited to an area of about an acre. Both the typical white-flowered form of *O. lanata*, L.f. and also a rose-coloured variety (var. *rosea*, Salter), differing only in their perfect flowers and rather longer peduncles, are plentiful on open ground about 100 yards away, but only a few flowering plants of var. *rosea* have been found in the plantation referred to.

The plants are thickly spread, sometimes forming carpets, but they only flower at all readily in the more open parts of the plantation. None, however occur on the open ground around.

Both the sepals and petals are densely pubescent and are bordered with a row of orange-coloured calli along the anterior margin. The sepals are entirely green, but the petals, which have a rather thick fleshy claw, are obscurely purple-maculate on the upper surface. All the flowers are of the medio-stylar form. The anthers, unlike those of the typical form, are tipped with a small tuft of hairs and have pollen sacs in their lower halves only and contain pollen grains which are shrunken and abortive. Although there appear to be no stigmas on the densely hirsute tapering styles, the ovules (3 in each chamber) are normal.

It seems evident that normal pollination never occurs and after a prolonged search I have failed to find any plants setting seed. It may therefore be concluded that propagation only takes place by vegetative means, *i.e.* by the slow process of spreading from the bulbilli, which, it may be noted, are produced in an almost sessile position on the rhizome and not on long lateral runners or underground stolons as is the case in some species in the genus.

The species *O. lanata* is peculiar in that it is often affected by a species of smut which attacks the anthers and bulbs, but the plants appear to be otherwise healthy. Var. *rosea* is not, of course, nearly so common as the typical white-flowered form, yet it seems to be more prone to infection. The virescent form is, as far as is known, entirely free from it. When the corollas are wide open in a strong light, infected

plants can often be detected from a distance of several feet by the dark brown appearance of the anthers.

I have not, so far, observed this smut on any other South African species of Oxalis.

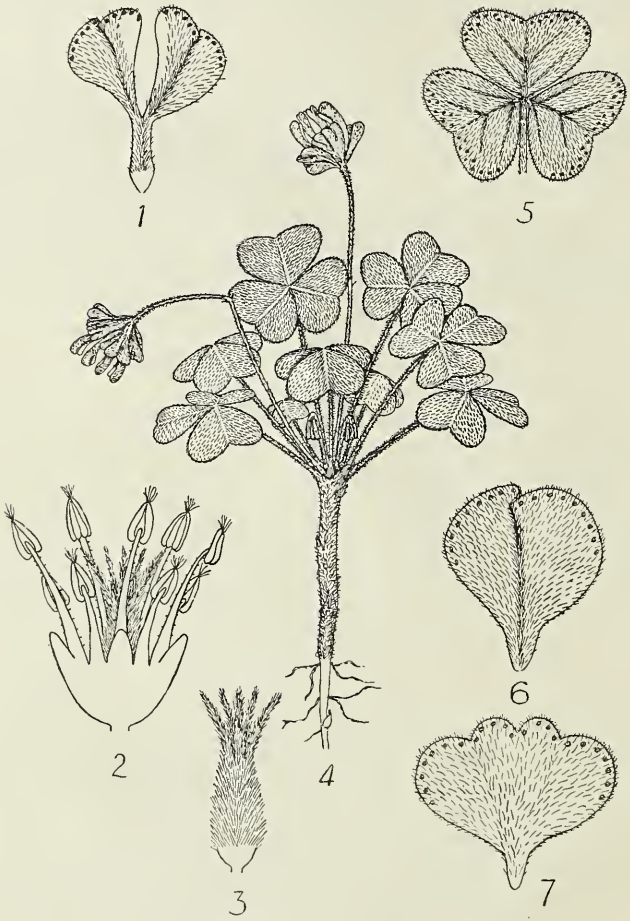

Fig. 5. *Oxalis lanata* L.f. with virescent flowers. 1. Petal × 4. 2. Androecium × 8. 3. Gynaecium × 8. 4. Plant × 2. 5. Leaf (under side) × 2. 6 and 7. Sepals × 4. (*Salter* 6163.) *Del.* T. M. Salter.

A NEW ALOE FROM LITTLE NAMAQUALAND.

(With Plates 4 and 5)

By G. W. Reynolds.

Aloe arenicola Reynolds. Species nova (Sect. *Mitriformes*).

Planta succulenta, e basi ramosa, caules procumbentes 3—4 cm. diam., usque ad 1 met. longi. *Folia* circiter 20, subdense rosulata, lanceolato-attenuata, usque ad 18 cm. longa, 5 cm. lata ; supra planiuscula, subtus convexa, utrinque caeruleo-viridia, copiose albo-maculata ; ad margines dentibus parvis albis ½ mm. longis 5—8 mm. distantibus instructa. *Inflorescentia* usque ad 50 cm. alta, simplex vel 1—2-ramosa. *Racemi* dense capitati, sub-corymbosi, 6 cm. longi, 9 cm. diam. *Bracteae* 10 mm. longae, basi 3—4 mm. latae, scariosae, circiter 5-nervatae. *Pedicelli* 35 mm. longi. *Perigonium* rubrum, cylindricum levissime curvatum, saepe 40 mm. longum. *Segmenta exteriora* per 20 mm. libera, patula, obscure nervata ; interiora libera, obtusiora, carinata, marginibus pallidioribus. *Genitalia* 3 mm. exserta. *Ovarium* 7 mm. longum, 3 mm. diam.

Hab. Cape Province, Little Namaqualand : Hondeklip Bay, Pillans 8368 !, fl. Oct. 1924 ; Witbank near Orange River mouth, Pillans 5117 !, fl. Oct. 1926 ; (in Bolus Herb. Kirstenbosch) ; in sand on the farm "Samson's Bak" 15 miles south of Kleinzee, Reynolds 2574 ! fl. 28 July 1937 (type), in National Herb. Pretoria, and in Bolus Herb. Kirstenbosch. [Plates 4 and 5.]

This new *Aloe* was first brought to my notice by Mr. P. van Heerde, Principal, Namaqualand High School, Springbok, who sent me plants collected at Hondeklip Bay, about 50 miles north-west of Garies and 75 miles south-west of Springbok, Little Namaqualand. Mr. van Heerde found plants at that locality in 1928, and writes concerning them : "There used to be large stretches of this *Aloe* from Hondeklip Bay to Kleinzee, but numbers have been destroyed by cattle, and especially sheep and goats. During the droughts the goats would practically live on these *Aloes* and would not require any water. When flocks were brought to waterholes, those which had grazed the *Aloes* would not go near the water."

During July, 1937, I made a special journey through the Richtersveld and Namaqualand with a view to investigating this and other *Aloe*

species, and visited Hondeklip Bay (*via* Soebatsfontein and Wallekraal), on 21 July. Plants were found about 5 miles from the sea, among low bushes in almost pure sand, but on that date none was in flower, only a few being in young bud. There was also evidence of a considerable number of plants having died out.

About 7 years ago Mr. Redmond Orpen found the same species near Kleinzee (between Hondeklip Bay and Port Nolloth) and I am indebted to him for kindly sending plants to Johannesburg. On 28 July 1937, I visited Kleinzee (which is about 65 miles west of Springbok, *via* Spektakel and Grootmist). From there Mr. Orpen kindly conducted me about 15 miles south, to the farm "Samson's Bak," a few miles inland from the sea. At that locality, large quantities were found, many being in full bloom. Photographs were taken and a description written up on the spot.

Subsequently, however, I learnt that Mr. N. S. Pillans was the first to discover the species. He writes: "The Kleinzee plant extends from Hondeklip Bay, where I gathered flowering material in October, 1924 (Pillans 8368), to Witbank not far from the Orange River mouth, where I gathered flowering material (Pillans 5117) in October, 1926." Mr. Pillans has also suggested the name *A. arenicola*, which I am adopting, since the species is certainly an inhabitant of almost pure sandy places. It grows under almost rainless conditions, the chief source of moisture being the result of condensation from mist and fog, common to the Namaqualand coastal stretch of sandveld during certain periods of the year.

In the National Herbarium, Pretoria, there are photographs taken by Dr. I. B. Pole Evans in April, 1927, of plants (not flowering) near Lamberts Bay, west of Clanwilliam, which bear a very striking resemblance to the Kleinzee plant. Does *A. arenicola* extend so far south?

A. arenicola is allied to *A. mitriformis* Mill. and *A. distans* Haw. in the section *Mitriformes*; in diameter of rosettes it is smaller than the former and larger than the latter. Whereas both *A. mitriformis* and *A. distans* develop sprawling stems foliate for 1 met. and more, *A. arenicola* has only the terminal 20 cm. foliate, the stems being procumbent with the foliate portion erect or suberect whether supported by bushes or in exposed positions. Leaves are much smaller than in *A. mitriformis*, and comparatively longer and narrower than in *A. distans*; they are bluish-green and white-spotted on both sides, while the margins are finely notched or serrate rather than dentate. In character of leaf and rosette, *A. arenicola* seems fairly constant, but it varies considerably in shape and size of flowers. From a quantity of material gathered at random it was found that pedicels varied from 25 mm. to 50 mm. in

FIG. 1. FIG. 2.

PLATE 4. *Aloe arenicola* Reynolds.

FIGS. 1—2. Plants in natural habitat, flowering 28 July 1937, on the farm "Samsons Bak," 15 miles south of Kleinzee, Little Namaqualand.

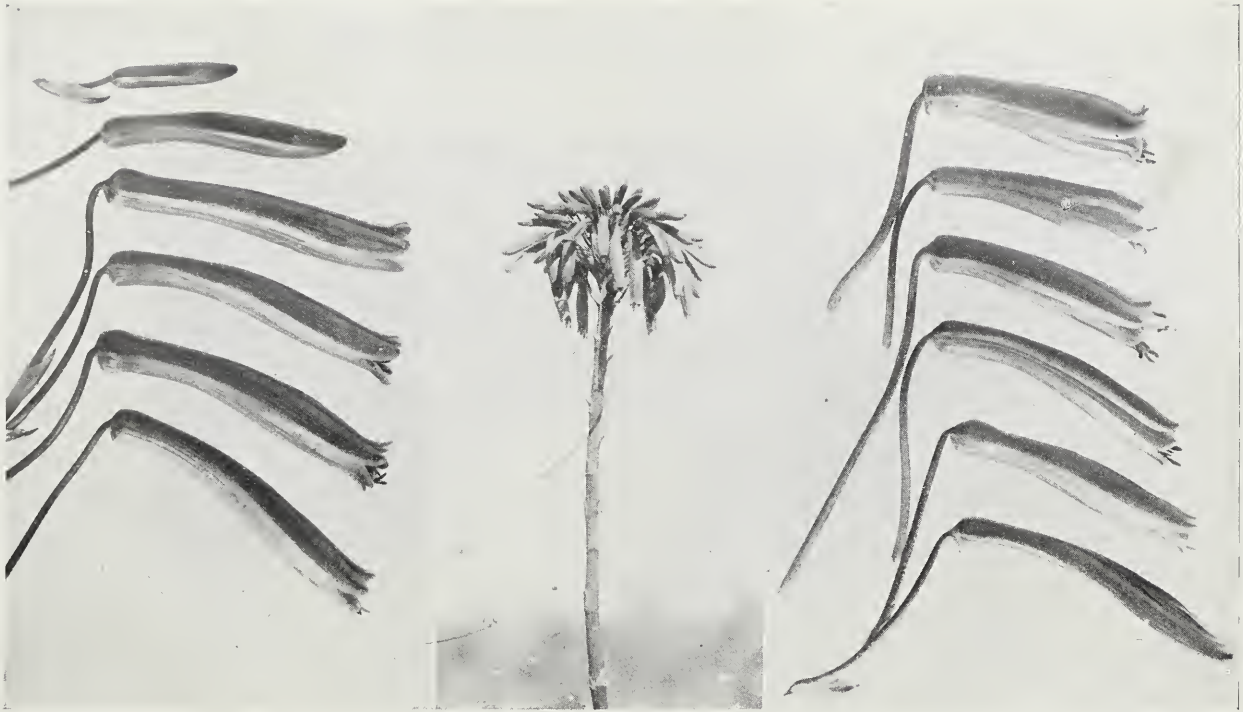

FIG. 1. FIG. 2. FIG. 3.

PLATE. 5. *Aloe arenicola* Reynolds.

FIG. 1. Flowers natural size, from bud to post-pollination stage.

FIG. 2. Portion of peduncle with raceme, × $\frac{1}{3}$ approx.

FIG. 3. Illustrating variation in shape and size of flowers, natural size.

length, and flowers from 35 mm. long (7 mm. diam. at base) to 46 mm. in length (5½ mm. diam. at base). It seems that the most typical form has pedicels 35 mm. long, and flowers 40 mm. long. Some of the forms are illustrated in the accompanying figure.

Racemes vary from corymbose to rounded, and are almost invariably broader than long. There is even greater variability in the structure of the outer segments of the perianth. In some flowers they were distinctly connate into a tube for half their length, but in others, they were tightly cohering (not adnate) to the inner segments for half their length, and could be freed to the base without tearing.

The following plants are at present in cultivation: In Garden of Bot. Section, Division of Plant Industry, Pretoria, No. 2999.7.37 *ex* Kleinzee, and No. 2988.7.37 *ex* Hondeklip Bay; in National Botanic Gardens, Kirstenbosch, No. 1220/37 *ex* Kleinzee.

Description:—Plant succulent with stems 3—4 cm. diam., simple or branched, up to 1 met. long, procumbent with the apical 20 cm. foliate and erect: stems sub-erect when supported by bushes, procumbent in open positions, with numerous off-shoots forming dense groups of erect rosettes. *Leaves* about 20 in a sub-dense rosette, lanceolate-attenuate, sheathing at base, up to 18 cm. long, 5·5 cm. broad near base; upper surface rather flat, slightly canaliculate towards apex; lower surface convex: both surfaces rather bluish-green with numerous irregularly scattered oblong white spots throughout, the spots sometimes slightly raised but hardly tuberculate; margins usually with a whitish horny edge, minutely serrate with teeth about ½ mm. long, 5—8 mm. distant. (*Note.*—In lower third, teeth are obsolete, the margins having a straight white horny edge; the middle third is somewhat serrate, while in upper third the teeth and horny edge are obsolete: apices of leaves usually terminate in a white spine.) *Inflorescence* up to 50 cm. high, simple or with one, occasionally two branches from about the middle. *Peduncle* flattened low down and about 2 cm. diam., with several ovate-acute 7—9-nerved sterile bracts below the racemes. *Racemes* densely capitate, usually rather corymbose, about 6 cm. long and 9 cm. diam. *Bracts* lowest 10 mm. long, 3—4 mm. broad at base, thin scarious about 5-nerved. *Pedicels* mostly 35 mm. long, sometimes reaching 50 mm. in length. *Perianth* frequently 40 mm. long, nearest Peach Red (R.C.S. I) turning paler at mouth, rather cylindrical or sometimes very slightly clavate, slightly curved. *Outer segments* free for 20 mm. from apex, the lower 20 mm. sometimes tightly cohering to the inner segments, or sometimes connate into a tube very obscurely nerved, the nerves greenish at apex, apices sub-acute, slightly spreading. *Inner segments* free but cohering to the outer for half their length, white with thin edges, with a

keel the colour of the perianth for its greater length turning greenish at apex, apices more obtuse more spreading than the outer. *Filaments* flattened, pale lemon throughout. *Anthers* exserted up to 3 mm. *Stigma* at length exserted 3 mm. *Ovary* 7 mm. long, 3 mm. diam. at base, slightly tapering into the style.

NOTES ON ALOE CLAVIFLORA, BURCHELL.

(With Plates 6 and 7.)

By G. W. Reynolds.

The purpose of this paper is to establish the identity of *Aloe claviflora* Burchell, and to show that *A. Schlechteri* Schonl. and *A. decora* Schonl. are conspecific.

In *Travels in the Interior of Southern Africa* by William J. Burchell, Vol. 1, p. 272, 1822, Burchell records the following observation for 24 August, 1811 :

> " We halted for the night in a rocky situation near a small river where the fine scarlet flowers of a new kind of *Aloe* decorated the barren rocks, and gave a certain gay, cultivated look to a spot, which, without them, would have appeared a rude, neglected waste.
>
> Among the plants found on the road from the Karree River, and at this station were . . . .
>
> Aloe claviflora. C.G. 1425.2. Acaulis. Folia elongata glauca, marginibus aculeatis. Flores dense spicati. Spica simplex. Corolla clavata, laciniis conniventibus."

No figure was published, and the short description left the identity of the species somewhat in doubt. Subsequent workers misinterpreted Burchell's species. In *Flora Capensis* VI (1896), p. 309, Baker queries it as *A. Ecklonis* Salm Dyck, while Berger (in *Das Pflanzenreich* Liliac.-Asphodel.-Aloin. 1908, p. 325), includes it, without comment, under " Species incertae et excludendae".

From the knowledge of an *Aloe* found in the Fraserburg Dist. to-day, guesses have been made as to the identity of *A. claviflora*, but there has remained a certain element of doubt.

This uncertainty can now fortunately be cleared up. Through the kindness of Mrs. H. M. McKay, I have examined some of Burchell's unpublished drawings belonging to the Gubbins Trustees, and now in the custody of the Witwatersrand University, Johannesburg. Drawing No. 332 is a colour wash, done in the field, in the vicinity of the Riet River, Fraserburg District, Cape Province. It is dated 25.8.1811, and is marked in pencil :

Aloe claviflora W.J.B. Cat. Geog. 1425/2. sp. nova ex Haw.

Burchell's reference to " ex Haw." is puzzling. I can find no reference to this *Aloe* by Haworth in any of his publications, but Mrs. McKay's interpretation is that Burchell may not have been quite sure whether he had discovered a new species, and that he might have written in the " sp. nova ex Haw." after having discussed the matter with Haworth.

Burchell in Drawing No. 332 figured a leaf, inflorescence, and flower with pedicel and bract. The leaf and inflorescence are reduced, but the flower is marked " mag. nat." and is 35 mm. in length, clavate, and tapers into the pedicel which is 8 mm. long. By kind permission of the Gubbins Trustees, and the Witwatersrand University, I photographed Burchell's original field drawing, and with their permission also, the photograph of this important drawing is reproduced herein. As will readily be seen, Burchell's drawing, especially of the flower, leaves no doubt as to the identity of his *A. claviflora*. It is unquestionably the species widely known as *A. Schlechteri* Schonl., although Schonland's original description is not as full as it might have been. Schonland described his *A. Schlechteri* from 1 leaf and 2 inflorescences in the Albany Museum Herb., collected by Max Schlechter in 1898 at Pella, Great Bushmanland. He states (Rec. Albany Mus. (1903) 45, et (1905) 295) " habit of growth not known . . . . also collected by K. Orpen at Douglas in Griqualand West."

I have visited the Fraserburg and Williston Districts, as well as Douglas, Griquatown, Upington and areas westwards into South-West Africa, and Burchell's drawing and short description certainly fit plants found in those localities, known as *A. Schlechteri*.

This being so, the name *A. claviflora* Burchell has priority and must be upheld, and *A. Schlechteri* Schonl. must be reduced to synonymy. It is indeed gratifying that Burchell is commemorated in the authorship of one species of *Aloe*.

A. decora Schonl. in *Gard. Chron.* (1905) 386 fig. 146, et Alb. Mus. Oct. 7, 1905 (with photograph) " collected by Miss K. Orpen, St. Clair, Douglas, Griqualand West, flowered in Grahamstown Sept., 1905 " is also conspecific with *A. claviflora*. Berger (l.c.) 219 recognised this by placing *A. decora* in the synonymy of *A. Schlechteri*, but like the latter name, it must now be referred to the synonymy of *A. claviflora*.

A. claviflora is very widely distributed in the Karroo and arid desert scrub country in the central and northern parts of the Cape Province, extending into the southern portion of S.W. Africa. Its most southerly stations are the Williston, Fraserburg, Beaufort West and Prince Albert Districts, extending as far east as Toekomst near Lake Mentz on the western border of the Somerset East District. It is found in the Victoria West and Middelburg Districts, but is more plentiful further north at Strydenburg, and generally in the country along the Orange River from

PLATE 6. *Aloe claviflora* Burchell.

Photographic reproduction of Burchell's original Drawing No. 332 (hitherto unpublished), done in the field in the vicinity of the Riet River, Fraserburg District, dated 25.8.1811,—slightly reduced.

Note.—On the same sheet, Burchell's Drawing No. 398 of *Rhigozum obovatum* appears, a portion of which is seen above.

Photographed and reproduced by permission of the Gubbins Trustees, Witwatersrand University, Johannesburg.

PLATE 7. *Aloe claviflora* Burchell.

ABOVE: Group of plants typical of the species, photographed near Douglas, C.P., fl. 29 August 1935.

BELOW: Flowers natural size, from bud to post-pollination stage.

the Koffiefontein and Luckhoff Districts of the south-western Orange Free State, through Hopetown, Douglas (abundant), Prieska, Upington (abundant), Pella, and into South-West Africa. I have also seen it near Griquatown and near Postmasburg, while in S.W. Africa it is found near the Orange River, near Warmbad, in the Warmbad district (Driekameelbaum) and Klein Karas north of Kalkfontein.

A. claviflora grows in raised well drained positions, on flat stony ground, or on rocky koppie slopes, and has a peculiar habit of growth. At first a small dense circular group appears, gradually the outer plants creep along the ground forming a complete or broken circle, while the inner ones die out in time, leaving the centre of the circle hollow, and often resembling the remains of a camp fire in appearance. As the circle enlarges, plants divide and fill up the gaps, while, when horse-shoe shaped groups are seen, the gap usually faces west. Usually 6—12 plants form a hollow circle 3—8 feet in diameter ; sometimes the circle is formed by a double row of plants and rarely by 3 rows. Between Luckhoff and the Orange River, and also between Hopetown and Strydenburg, I have seen dense solid groups of 50 and more plants, but groups this size are unusual. This peculiar habit of growth is also found in *A. falcata* Bak. (Van Rhynsdorp—Khamieskroon), but *A falcata* has larger rosettes, a 4—7 branched inflorescence, and different flowers.

To the early Dutch settlers, *A claviflora* was known as "Kanons," (from the characteristic angle of the inflorescence, and also possibly from the rosettes somewhat resembling cannon balls) and the "Aanteel Alwyn"—the increasing *Aloe*.

In localities furthest south and east, the inflorescence is mostly simple, sometimes forked, and usually appears in August—September. In its furthest west distribution, *i.e.* in S.W. Africa, Mr. W. F. Bayer, Magistrate, Warmbad, records that along the Orange River at Naros, about 12 miles above Velloordrift (Onseepkans), the inflorescence is usually simple or forked, but that the plants further north near Warmbad almost invariably produce inflorescences with 3—4 branches, and flower in September—October.

The inflorescence, whether simple or branched, always lies at an oblique angle, often almost horizontally, while in the racemes, there is a tendency for the uppermost flowers to hang over sideways. Usually the buds and youngest flowers are red with a bloom and greenish tipped, the oldest flowers eventually turning lemon-yellow to ivory after pollination. Flowers vary from 30 mm. to 40 mm. in length and are invariably clavate, and gradually taper into the pedicel, which is clearly shown in the accompanying figure.

In cultivation, it is essential to give good drainage and no water,

since plants rot freely. The few plants which have flowered in Johannesburg were planted with stems resting *on top* of a bed of pebbles. Planting stems *in* the ground and watering, is almost always fatal.

In the wild state, stems lie along the ground with rosettes upturned, but as an experiment, I have placed a plant in an upright position to ascertain whether an erect inflorescence would result. At first the spike was pushed up erectly, but with development, the inflorescence turned over sideways with the raceme almost horizontal.

Brief reference may be made to natural hybrids. I have seen the following :

1. *A. claviflora* × *A. Broomii* Schonl. occurs on koppies near Saltpan, about 17 miles east of Witput Station ; 13 miles east of Krankuil Station ; forms circular groups, inflorescence simple, sub-erect.
2. *A. claviflora* × *A. grandidentata* Salm Dyck is plentiful in koppies west of Strydenburg, also near Hopetown ; forms circular groups, inflorescence branched and lying at an oblique angle.
3. *A. claviflora* × *A. gariepensis* Pillans occurs at Warmbad, S.W. Africa. I have seen plants at Warmbad but not flowers, but from photographs kindly sent by Mr. W. F. Bayer this cross also forms groups, inflorescence is branched and sub-erect. *Note.*—In *A. gariepensis* inflorescence is simple, while the Warmbad form of *A. claviflora* is 3—4 branched.
4. *A. claviflora* × *A. hereroensis* Engler, hills west of Strydenburg, near Hopetown, between Griquatown and Postmasburg. A particularly handsome plant, forms groups, inflorescence branched and sub-erect, racemes intermediate.

From a study of numerous hybrids in their wild state, it seems to me, that dominant characters of what appear to be F_1 crosses with *A. claviflora* one parent, are the forming of circular groups and the oblique inflorescence. The immaculate glaucous leaf character seems to be recessive, since in *A. claviflora* × *A. grandidentata* I have always noticed spots. The character of clavate perianth (tapering into the pedicel) also appears to be recessive, since in crosses of *A. claviflora* × *A. grandidentata* and *A. claviflora* × *A. hereroensis* I have noticed that the base of perianth was rounded and cylindric. It must, however, be pointed out, that at Strydenburg and Hopetown the confusion of hybrid segregates is so great, that the precise identification of some plants seen is impossible.

The following amplified description of *A. claviflora* is based on personal observations during the last 5 years at most of the localities above cited :

Aloe claviflora Burchell in *Burch. Trav.* 1. (1822), p. 272.—*A. Schlechteri* Schonl. in *Rec. Alb. Mus.* 1. (1903) 45 et (1905) 295; Berger *Das Pflanzenreich* (1908) 219; *Fl. Plants S. Af.* vol. IV (1924) Plate 151.—*A. decora* Schonl. in *Gard. Chron.* (1905) II p. 386 fig. 146.

Description :—Plant succulent, acaulescent or with procumbent stems 10—20 cm. long, usually forming hollow circular groups 1—2 met. diam. *Leaves* 30—40 in a decumbent dense rosette, the lowest arcuate-erect, the lateral falcately upturned, ovate-lanceolate, about 20 cm. long, 6—8 cm. broad at base : upper surface flat to slightly convex, glaucous immaculate ; lower surface convex, glaucous unspotted, 1—2-carinate in upper third, the keel armed with 4—6 isolated brownish spines 2—4 mm. long ; margins armed with pungent brownish isolated teeth 2—4 mm. long about 10 mm. distant, the interspaces straight, the colour of the leaf. *Inflorescence* up to 50 cm. long, 1—2 from a rosette, simple or bifurcate, sometimes 3—4-branched, obliquely disposed. *Peduncle* stout, 20—30 mm. long below the raceme, sterile bracteate, the bracts ovate-acuminate thin scarious white, about 15 mm. broad, 25 mm. long, about 12-nerved. *Racemes* densely multiflowered, cylindric-acuminate, 20—30 cm. long, buds and younger flowers red with a bloom, greenish tipped, older flowers paler, eventually turning lemon-yellow to ivory after pollination. *Bracts* usually narrowly ovate-acute, thin scarious white reflexed, about 15 mm. long, 6—8 mm. broad, 5—10-nerved. *Pedicels* 7—10 mm. long. *Perianth* clavate-cylindrical, 30—40 mm. long (mostly about 35 mm.), about 10 mm. diam. at widest part, roundly trigonous near throat gradually tapering into the pedicel. *Outer segments* free for $\frac{1}{4}$—$\frac{1}{2}$ their length, with 3 greenish nerves confluent at apex, apices sub-acute spreading. *Inner segments* free but dorsally adnate to the outer for about half their length, broader than the outer, with white margins and 3 congested nerves forming a keel reddish in lower two-thirds turning greenish upwards, apices more obtuse and more spreading than the outer. *Filaments* pale yellow throughout, flattened, the 3 inner narrower and lengthening in advance of the 3 outer. *Anthers* the 3 inner and 3 outer in turn exserted 10—15 mm. *Stigma* at length exserted 15 mm. and remaining exserted after pollination. *Ovary* 8 mm. long, 3 mm. diam., finely 6-grooved, lemon-yellow to olive-green.

Hab.—Cape Province : near Kuruman, 6 Sept. 1917, Nat. Herb. 193 ! ; Beaufort West, Aug. 1921, Marloth 11000 ! ; Upington, Borcherds without number ! : Middelburg, 16 Oct. 1935, Repton 454 ! ; Strydenburg, 3 Aug. 1935, Reynolds 1551 ! : Hopetown, 29 Aug. 1935, Reynolds 1548 ! ; Douglas, 29 Aug. 1935, Reynolds 1547 ! (typical). Orange Free State : near Luckhoff, 2 Sept. 1935, Reynolds 1569 ! ; 12 miles east of Koffiefontein, 3 Sept. 1935, Reynolds 1570 ! South-West Africa :

Klein Karas, 1 Sept. 1923, K. Dinter 4805 ! All in Nat. Herb Pretoria. The following in Albany Mus. Herb. : Pella, Great Bushmanland 16/8/98, Schlechter 133 ! (type *A. Schlechteri* Schonl.) ; St. Clair Douglas, Miss K. Orpen ! fl. Sept. 1905 in Grahamstown (type *A. decora* Schonl.). *Note.*—Schlechter 133 ! is dated 16/8/98 not 16/1/98 as cited by Schonland (l.c.) and Berger (l.c.).

REVIEWS AND ABSTRACTS.

Flora of Tropical Africa, ed. by Sir A. W. Hill, K.C.M.G., F.R.S., etc., vol. x, part 1, *Arundinella to Agrostis*, by E. C. Hubbard, 1937. L. Reeve & Co., price, 15/-.

When the Flora of Tropical Africa was first planned and commenced in 1868 an account of the Grasses extending into two volumes could not have been foreseen, and the authorities at Kew could scarcely have been blamed if, in 1918 when vol. ix—Gramineae—commenced, they had anticipated the vastness of the undertaking and had been content with a briefer and less adequate treatment. As it is we feel that all workers on the African Flora will join in congratulating them in carrying out the undertaking and particularly in their choice of two such patient and accurate monographers as Dr. Stapf and Mr. Hubbard.

The latter, after concluding the final part of vol. ix in partnership with Stapf—alas! no longer with us—assumes the whole responsibility for the new part. And may we say at once that the present volume in thoroughness, clarity and scope maintains the high standard of its predecessors.

Two new genera described by Mr. Hubbard in Kew Bulletin for 1936 are fitted in: *Phaenanthoecium* following *Danthonia* and *Hypseochloa* next to *Agrostis*.

Genera dealt with, which were not envisaged in the initial delimitation in 1918, include *Loudetia* (separated from *Trichopteryx*), *Gilgiochloa* (from *Danthoniopsis*), *Trisetum* (from *Koeleria*), *Streblochaete* (from *Danthonia*), *Coelachne* and *Arundo*.

Schismus is transferred from the Festucae to the Avenae and placed next to *Danthonia* while *Thysanolaena*—the type genus of Hubbard's new tribe the Thysanolaenae—appears next to *Lintonia*.

We, for our part, have always looked forward keenly to the appearance of new parts of the Gramineae, and, if we have often waxed impatient, it is only that, in our experience, work with genera not yet included is scarcely practicable. H. B. G.

Conspectus Florae Angolensis, ed. by Dr. L. Wittnich Carisso, vol. 1, Ranunculaceae—Malvaceae, by A. W. Exell and F. A. Mendonça. Agência Geral das Colónias. Lisbon, Jan. 1937, 50$00 esc.

Collaboration between scientific workers is no new thing but the fruitful collaboration of two workers of different nationalities is sufficiently infrequent to call for appreciative comment. Mr. A. W. Exell, of the staff of the British Museum, and Sr. F. A. Mendonça, of the Instituto Botanico de Coimbra, are to be congratulated in their successful co-operation, under the editorship of Dr. Carisso, to produce this first volume of the Conspectus Florae Angolensis which has been so eagerly anticipated.

The work covers the families Ranunculaceae to Malvaceae arranged according to the well-tried system of Bentham and Hooker, with generic

arrangements often following recent monographic work. The assistance of Dr. H. Sleumer for the Flacourtiaceae and Dr. Helen Bancroft for the Dipterocarpaceae has been happily secured.

The material cited consists chiefly of the well-known collections of Dr. Welwitsch and Mr. John Gossweiler which have been worked over by the staff of the British Museum and reported on in a series of Supplements to the Journal of Botany.

The species concept adopted is a wide one and wisely so with an area where few field botanists are present to check herbarium distinctions.

The genera and species are described by means of dichotomous keys and the specific descriptions are expanded by means of a short note on the habit and ecology which field workers in particular will value greatly.

If we have any regret it is that concise descriptions of the families could not have been included, since there is no existing guide in Portuguese to the affinities of a plant.

We look forward with keen interest to the appearance of further volumes of this work. H. B. G.

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The Geology and Archeology of the Vaal River Basin, by P. G. Solnge and D. J. L. Visser (Geologists) and Professor C. van Riet Lowe (Director, Bureau of Archeology). Memoir no. 35, Geological Survey. Government Printer, Pretoria. 1937. 5/-.

The origin of our South African Flora has for long been a matter of argument. Some authors suggest a spread of the South-Western type, migrating east and north, while others would look on the South-West as a cul-de-sac where plants have accumulated from a continual migrational stream down the East African escarpment from the Mediterranean.

Coupled with the larger field is necessarily the occurrence of anomalies such as the discovery of *Podocarpus* in the Waterberg 20 miles west of Naboomspruit by Dr. Galpin, of *Olinia*, *Apodytes* and *Cyathea* in the Magaliesberg by Prof. Phillips and the relationship of the flora of the Umvukwe Hills to the eastern border vegetation of S. Rhodesia attested by Mr. J. Kelly Edwards.

The eastern spread of desert eonditions and vegetation of the present time, though perhaps in large part due to human agency, brings further evidence of migration.

And when Rogers (1922) concluded that the climate of post-cretaceous time in Southern Africa had varied between very narrow limits and Bremekamp (1935) suggested "that there is no botanical evidence to suggest the assumption of a pluvial period following the desert period" in the Kalahari it seemed that a clue to the position would be hard to find.

Manifestly much of the difficulty lay, assuming that migration could be interpreted as climate-induced and to depend on the age of a type, in defining and the equivalence of climatic terms.

It is therefore with considerable pleasure that we note in the introduction to the first part of this work, where the geological evidence for fluctuations in the climate of Quaternary times is reviewed and evaluated as a background for the Archeological picture, a careful effort to define the terms used.

That the Geologists, with all their caution and disavowal of the conclusiveness of their work, should be able to present so illuminating a picture as that on p. 56 of this paper, will come as an inspiration to all African Biologists. Three wet phases, of which the first is the longest, alternating with a semi-arid and two arid periods are shown leading on to the present semi-arid.

Here we have a clue which, we believe, may lead ultimately to as complete an explanation of our Flora as has been given for the British Flora by Matthews.

The section devoted to Archeology, while necessarily specialised, gives us the first clearly enunciated sequence of Man's cultures in Southern Africa and draws a picture of human work which will be most meaningful to all students of Africa's past history.

Between the lines we occasionally catch a glimpse of the notion that the pluvial and interpluvial periods of our African climate may be linked with the glacial and interglacial phases of Quaternary Europe so that we join most cordially in the conlusion (p. 56): "It is hoped that the facts elucidated in the course of this Geological Survey and the suggestions that have been advanced as to climatic changes within the Vaal River area during Quaternary times will form a basis for further detailed work in other South African areas, so that in course of time, when co-ordination of information becomes possible, an attempt will be made at a correlation of the climatic changes which occurred in the African region with those of higher latitudes."

H. B. G.

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VOL. IV.

THE UTILITY OF AERIAL PHOTOGRAPHS AS AN AID TO BOTANICAL SURVEY.

(With Plates 8—10)

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CONTENTS.

INTRODUCTION.

During the year 1936 a number of excursions were made by Professor John Phillips and several of his students to the farm Blyvooruitzicht No. 71 near the town of Oberholzer on the West Rand.

With the aid of aerial photographs kindly supplied by Captain Robbins of the Aircraft Operating Company, investigations upon the ecology of the flora in relation to the geology and other factors of the region, were made.

One of the main objects of these investigations was to test the utility of aerial photographs as an aid to Botanical survey. At first sight, difficulty was encountered in recognising the different geological types and their relationship to the flora, but with the aid of Mr. N. Thamm who has mapped that region in great detail for the West Witwatersrand Areas, Ltd., a fair degree of accuracy in recognising these types, and the accompanying plant communities upon them, was soon attained. In fact the aerial photographs were found of infinite value in estimating the comparative age and advancement of plant succession upon cultivated sites, overstocked sites, localities of native kraals, and roads and paths. Scrub types such as *Protea* other species open Woodland, *Royena*, *Rhus*, *Celtis*, *Zizyphus* and *Acacia* communities were easily discerned after a little practice, and in several instances it was found possible to guess the species of individual trees from the photographs.

Exotic trees such as *Eucalyptus spp.* and *Black Wattles* were easily picked out from the photographs since they were usually planted in straight lines.

One of the chief objections to the use of aerial photographs is that cloud shadows on them give a false impression as to the type of country being studied. This, however, is not of great importance in the present investigation since only a few of the photographs have shadows upon them.

THE GEOLOGY OF THE REGION.

The region is on what is known as the "Transvaal System." This system is made up of the following series :—

- Transvaal System
  - Pretoria Series
    - Daspoort Beds
      - Amygdaloidal Andesite.
      - Shales.
    - Timeball Hill Beds
      - Upper Quartzites.
      - Shales.
      - Lower Quartzites, or Polo Ground Quartzite.
      - Shales.
      - Chert Conglomerate.
  - Dolomite Series.
  - Black Reef Series.

The scope of the paper is confined to the Dolomite and Pretoria Series.

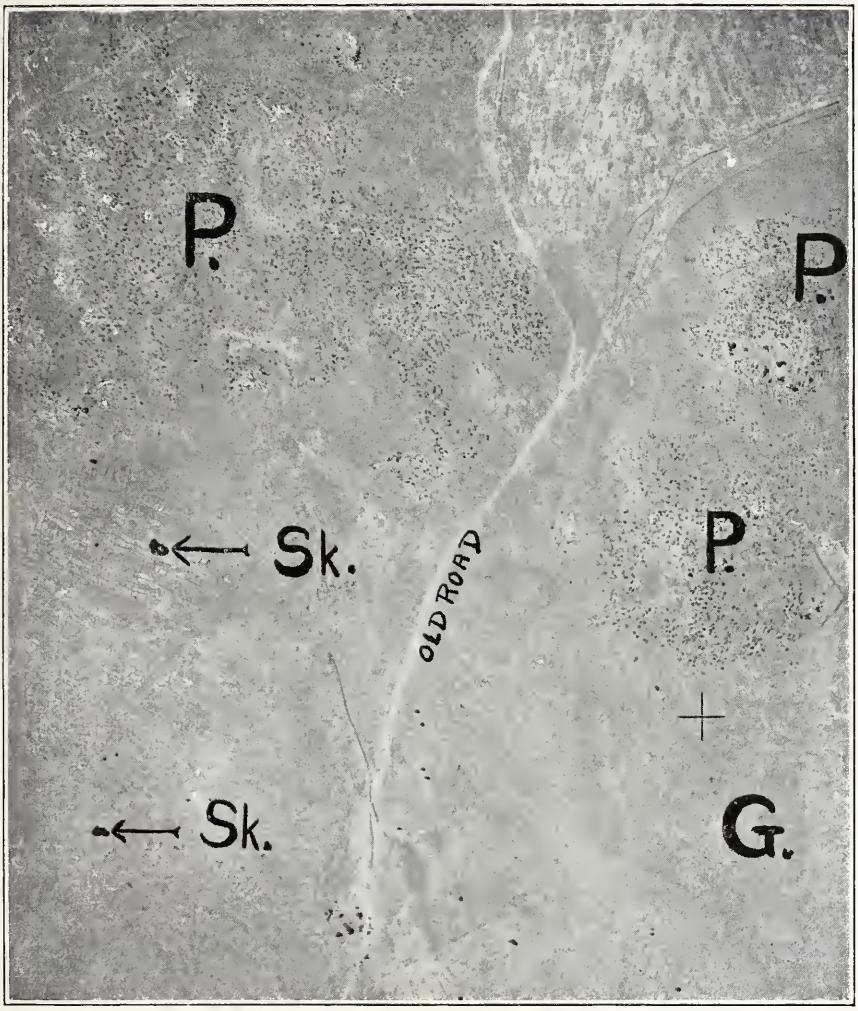

PLATE 8.
G. = Undisturbed Veld. Sk. = Simkhole. P. = Protea.

PLATE 9.
C. = Cynodon Dactylon. OF. = Old Fallows.

The Dolomite Series.

This series usually comprises more or less flat undulating country, broken here and there by an outcrop of a quartz vein or a lens of chert. Sinkholes are common in the dolomite, and are usually marked by a clump of trees, such as *Celtis kraussiana, Olea verrucosa, Zizyphus mucronata, Rhus sp.* and *Royena pallens.*

The Timeball Hill Beds.

(*a*) *The Chert Conglomerate.*

Just above the Dolomite is a Chert Conglomerate which looks as if it could more correctly be called breccia, on account of the erratic size and angularity of the pebbles. This Chert Conglomerate usually outcrops as small "koppies."

(*b*) *Lower Quartzite or Polo Ground Quartzite.*

Between the Chert Conglomerate and the Polo Ground Quartzite is a shale band, which varies considerably in thickness.

The Quartzites are a greyish-brown colour, are coarsely granular, and weather by breaking up into large more or less square boulders. As the weathering advances, the cracks between these boulders widen and deepen, and grasses and bushes grow out of them. The Polo Ground Quartzites often outcrop as low-lying hills. Sinkholes are common in the Quartzites and it is not unusual for the hills described above to have sinkholes in the middle of them, giving them a crater-like appearance.

These sinkholes are probably formed by the collapse of the overlying beds into caverns in the Dolomite made by the underground water. Above them lies another band of shales, and then the upper Quartzite of the Timeball Hill Series.

THE TOPOGRAPHY OF THE COUNTRY.

To the North lies a broad flat valley, running approximately east to west. On the Southern side of the valley is a ridge of hills which comprise the Timeball Hill group of the Pretoria Series. (It was in this region that most of the work embodied in the paper was carried out.) To the South of the ridge is another valley running parallel with the ridge, and after this valley comes another higher ridge of hills.

An extract from the booklet supplied with the Geological map of the region made for the Department of Mines, ought to elucidate the above description :

> "In the south-east the more or less east-westerly trending range of the Gatsrand with its comparatively steep northerly escarpment

slope, constitutes an imposing physical feature in the area under review. From any point on one of the many projecting spurs of this range, an open view can be obtained of the Dolomite country at some distance towards the north, while in the foreground rounded rises formed by the uppermost chert in the Dolomite Series are clearly visible. From the railway line in the neighbourhood of Welverdiend, and Bank Station, the reverse aspect of the country presents itself. There is a rise, at first gradual, from the low-lying Dolomite plain up to the chert hills, and the terracelike feature of the shales and diabase at the base of the range, and then suddenly a more rapid rise culminating in the rough escarpment of the Gatsrand proper. Whereas the highest ridge is generally formed of the uppermost quartzite of the Timeball Hill stage, occasionally, the diabase intrusive into the sedimentary beds gives rise to crescentic peaks standing above the general level. Towards the south, the gentle dip slopes of the quartzite composing this ridge, generally thickly covered with sugar bush, die out in a more or less longitudinal depression underlain by shales, and having as a southerly margin the rounded hogsback hills of Amygdaloidal lava. Beyond these in a southerly direction one crosses the ridge of the Daspoort Quartzite, generally not prominent compared with those of the lava ; and the Gatsrand before descending towards the valley of the Loop Spruit in the neighbourhood of Fochville." (J.W.)

The mean annual rainfall on Wonderfontein, the adjoining farm to the north is 24·18 inches.

THE MAIN TYPES OF FLORA OF THE REGION.

1. *Grassland including Disturbed Sites such as Old Cultivated Lands.*
2. *Protea Other Species Open Woodland.*
3. *Acacia, Rhus, Royena Other Species Scrub Types.*

1. Grassland.

This may again be subdivided into the following types :

(*a*) **More or less undisturbed grassland,** on the flatter, less stony country, such as the Dolomite region.

The cover is low, approximately 10 per cent., but the species are good, and the soil is much richer than the granite soil on Frankenwald. The regions are recognised on the photographs as evenly coloured homogeneous areas.

PLATE 10.
Ac. = Acacia Scrub. O.F. = Old Fallows.

The more abundant species are :—

Grasses :

Andropogon amplectens
Alloteropsis semialata
Brachiaria serrata
Cymbopogon plurinodis
Diplachne biflora
Elyonurus argenteus
Eragrostis chalcantha
Heteropogon contortus
Monocymbium ceresiiforme
Schizachyrium semiberbe
Themeda triandra
Urelytrum squarrosum

Other Angiosperms :

Acalypha angustata
Asclepias stellifera
Becium hians
Buphane toxicaria
Cassia minosoides
Dicoma anomala
Elephantorrhiza elephantina
Euphorbia truncata
Gazania pygmaea
Gnidia caffra
Gnidia cano-argentea
Hypoxis sp.
Ipomoea spp.
Pachystigma pygmaea
Pygmaeothamnus Zeyheri
Scabiosa anthemifolia
Senecio venosus
Silene oliveriana
Sphenostylis angustifolia
Vernonia monocephala

Here and there local patches of *Sphenostylis angustifolia*, *Pachystigma pygmaea* and *Pygmaeothamnus Zeyheri* are frequent.

(*b*) **Grassland on stony regions such as hill slopes.**

This type is very similar to the above type and probably incorporates all the species in it. The difference, however, is that the grass is much more bunchy in type, and there is a greater tendency towards local developments of certain species, as for instance, the occurrence of *Schizachyrium*, *Sporobolus centrifugus* and *Digitaria tricholaenoides* is locally frequent to locally abundant especially on the shales, whereas their occurence is only occasional in the flatter regions with deeper soil. These stony regions appear very similar on the photo to undisturbed veld but may be recognised by changes in tint representing rock outcrops.

(*c*) **Grassveld on the site of some recent or remote disturbance** such as old cultivated lands, overstocked and trampled areas, for example veld in the neighbourhood of old native kraals, and old roads and paths.

(i) *Old Cultivated Lands.*

The comparative age of old cultivated lands can often be estimated by the composition of the grass and other species found on them. For example, recently cultivated ground will have an abundance of weeds, such as *Gnaphalium undulatum*, *Senecio laevigatus*, *Datura Stramonium*, *Gomphrena globosa*, *Amaranthus Thunbergii*, *Tagetes minuta*, grasses such as *Aristida barbicollis*, *Eleusine indica*, *Chloris virgata*, *Panicum laevifolium*, and if the land has been cultivated for some time there will be an abundance of *Cynodon Dactylon*.

Cynodon Dactylon is usually brought into cultivated land as seeds in manure, or else small existing patches of *Cynodon*, such as those on old termitaria are induced to spread by the methods of cultivation, for instance, rhizomes are broken up and dragged some distance by ploughing and harrowing, and these rhizomes take root and spread.

If *Cynodon* has not become well established on a land before it is left it is unlikely that it will ever spread profusely, but once it has become established it remains for a great length of time, perhaps as long as a hundred years. Aerial photographs are very useful in indicating the sites of cultivated lands, for even after periods of twenty years, plough marks, unnoticeable on the ground are distinctly discernable on photographs.

As the age of the disturbance increases, the early weeds and grasses tend to disappear, and give place, first to several species of *Eragrostis*, then to local patches of *Hyparrhenia hirta*, *Rhyncelytrum roseum* and *Cymbopogon plurinodis*, which in turn give place to plants such as *Schizachyrium semiberbe*, *Sphenostylis angustifolia*, and eventually, after a period of perhaps 50—150 years, the stage of undisturbed veld is reached again.

(ii) *Overstocked and Trampled Areas.*

This type shows as light or mottled patches on aerial photographs. On the ground, however, the grass is often cropped very short, bare spaces are numerous, and large local patches of *Zizyphus zeyheriana* are frequent. If the period of overgrazing and trampling is of some duration, there will be a marked influx of weeds, and fairly large patches of *Cynodon dactylon* will be evident.

(iii) *Areas on Sites of, or near old or recent Native Kraals.*

Kraals are easily recognised on the aerial photographs, for there are usually numerous large patches of *Cynodon dactylon* in or around the kraals, and these patches show as light, almost white areas on the photographs; very often even the outlines of the ruined walls can be seen. From the air it is difficult to discriminate between old and recent kraals, except that old kraals were, as a rule, built in the shelter of hills, and appear as groups of circular specks, whereas recent ones, are really not kraals but houses, and frequently appear singly, most often in the open veld.

(iv) *Old Roads and Paths.*

These, even when of great age, are distinctly defined on aerial photographs, and their sites are, as a general rule, marked by lines of tall *Hyparrhenia hirta* or *Schizachyrium semiberbe*.

2. Protea—Other Species Open Woodland.

This type is very wide-spread, occurring on almost all types of formations, but appears to be most extensive in the Dolomite country, and on the Chert Conglomerate although it is also common on Polo Ground Quartzite. On the photographs *Proteas* appear as small black specks, fairly wide apart but very evenly distributed, of a more or less uniform size, and are generally located on the slopes or near the foot of a hill, but are seldom densely intermingled with other types of woodland.

The *Proteas* commonly grow in veld of the undisturbed or stony variety ; *Protea caffra* is the commonest species found in this area.

3. Acacia, Rhus, Royena—Other Species Scrub Types.

This type is often found in more protected places, such as sinkholes, the northern aspect of ridges, or very uneven stony country.

On aerial photographs clumps of this type of bush occur as large closely grouped black dots, when they occur on outcrops, or as one large black dot when they indicate sinkholes.

When a fair degree of efficiency has been attained in the use of these photographs, individual species such as *Olea verrucosa*, *Royena pallens*, etc., can be picked out with the aid of a lens, by the size, depth of colour and shape of the dots.

The common species belonging to this type are :—

Grasses.

Andropogon amplectens
Cymbopogon plurinodis
Cymbopogon excavatus
Digitaria eriantha
Eragrostis spp.
Eustachys paspaloides
Hyparrhenia hirta
Rhyncelytrum setifolium
Setaria spp.
Sporobolus spp.
Themeda triandra

Other Angiosperms.

Acacia caffra
Acacia Karroo
Acacia robusta
Acalypha angustata
Achyranthes aspera
Asparagus spp.
Aloe transvaalensis
Brachylaena discolor
Celtis kraussiana
Clematis brachiata
Cluytia pulchella
Carissa arduina
Chilianthus arboreus
Cotyledon sp.
Cussonia spicata
Dombeya rotundifolia
Ehretia hottentotica
Euclea lanceolata
Euclea undulata
Fagara magalismontana
Gymnosporia buxifolia
Haemanthus magnificus
Heteromorpha arborescens
Hypoxis sp.
Kiggelaria africana
Lantana salvifolia
Olea verrucosa
Pittosporum viridiflorum
Plectronia mundtii
Rhus discolor
Rhus Gueinzii
Rhus lancea
Rhus spp.
Royena pallens
Royena microphylla
Solanum nigrum
Solanum sisymbriifolium
Vangueria infausta
Vellozia retinervis
Zizyphus mucronata

Apart from the type just described, scrub is found growing along the watercourses, the more important species of which are similar to the above, with the addition of *Buddleia salvifolia*, several species of *Cyperus*, *Rubus sp.*, *Typha australis*, and *Phragmites communis*.

It is worthy of note that *Streptocarpus vandeleuri* was found growing between some boulders of the Polo Ground Quartzites.

Communities of *Stoebe vulgaris* are common, and sometimes of fairly considerable extent. They usually denote the sites of overgrazed areas or old roads and paths, and sometimes of old cultivated lands. *Stoebe* communities are not clearly defined on aerial photographs, but present a somewhat smudgy mottled appearance. Possibly after some experience these localities could be recognised with a fair amount of accuracy.

CONCLUSIONS.

In conclusion, with special reference to the area under discussion, the following facts are worthy of note :—

Aerial photographs are of considerable aid in Botanical survey when used as maps, for they give a bird's-eye view of the country under observation, and indicate the most tangible landmarks to work by. They are also of great value in indicating the localities of depressions such as *sinkholes*.

Old lands and other disturbed sites, difficult to discern on the ground, are clearly shown on the photographs by dark lines showing plough furrows, by an abrupt change in colour, or by a change in tint.

After some experience, different *Scrub Types* can be recognised by the *size* and *density* of the dark spots shown on the photographs. *Mixed and undisturbed veld* can be recognised as even, homogeneous coloured areas.

The use of aerial photographs facilitates Botanical survey so considerably, that an area which would otherwise take a long time to investigate may be done in great detail in a comparatively short time. The photographs have, however, certain drawbacks, the most important of which are :—

(1) On account of the changes which country undergoes from season to season and from year to year, the photographs should be used as soon as possible after they have been taken, or if this is impossible, during the *same season* the following year. Photographs taken in one season are not strictly accurate for use at other seasons, on account of veld changes, colour variations and so forth.

The photographs described in this paper were taken in March 1933, whereas investigation of the area which they covered was not begun

until May of 1936, and it was found that roads existing in 1936 were not shown ; also several seasonal changes such as colour were not registered, or *vice versa*.

(2) Another drawback may be cloud shadows on the photographs. These shadows may be so dark that they may tend to obscure the appearance of the country.

(3) The line of strike of a dyke can often be quite clearly discerned on a photograph, but is quite impossible to find on the ground, either from change of colour of the vegetation or any other way. This, however, though not of any significance to the botanist, is of great value to the geologist, as an aid towards finding localities and lines of strike of dykes.

(4) The adherence of certain vegetation types to certain geological strata was not found to exist to any appreciable extent in this area, though it was found that there was a tendency for types of vegetation to appear on the same aspects *fairly consistently*, e.g. *Protea*, etc. This fact, however, is dependent on a great number of factors, such as protection from wind, cold, fire, soil moisture and pH of the soil.

From the geological point of view (as has been proved many times), these photographs are invaluable.

After some experience certain vegetation types can be recognised on aerial photographs by the following methods :—

(1) *Mixed veld.* This can be recognised by its even colour and homogeneous appearance.

(2) *Old Ploughed Lands.* These are recognisable by their striated appearance caused by plough furrows and their regular outlines.

(3) *Cynodon.* Patches are represented by whitish smudges.

(4) *Protea—Other Species Open Woodland.* This is shown as stippling, the dots being very even in size and distribution.

(5) *Scrub Types, Acacia Karroo, Acacia caffra, etc.* These are shown by dense or unevenly scattered accumulations of black dots of varying sizes.

(6) *Sinkholes.* Are shown as one large dark spot.

(7) *Stoebe vulgaris communities.* Are represented by a smudgy, mottled appearance.

SUMMARY.

1. Introduction in which is given a description of the circumstances under which the work was done.

2. The Geology of the region is described.

3. A description of the Topography of the region is given.

4. Descriptions with lists of plant names are given for each of the ecological types recognisable on the photographs.

5. Conclusions as to relative merits and demerits of aerial photographs as an aid to Botanical survey, are discussed.

ACKNOWLEDGMENTS.

The author is indebted to Dr. John Phillips, Professor of Botany at the University of the Witwatersrand, in whose Department and with whose guidance this work was done; to Captain C. R. Robbins and Mr. Williamson of the Aircraft Operating Company, who very kindly supplied the maps and aerial photographs required; to Mr. N. Thamm of the West Witwatersrand Areas, Ltd., a number of whose hints are embodied in this paper; and to Mr. R. Rose-Innes who assisted with the field work.

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A NEW MOUNTAIN PROTEA.

By E. P. Phillips, D.Sc.

Principal Botanist, Division of Plant Industry.

The species of *Protea* described below differs from any described species known to the author. As *Protea cynaroides* differs from all other caulescent species in the genus in having petioled leaves, so the species described below is unique in the genus in having the perianth-segments produced into long awns. The discovery of such a striking plant is evidence that our mountain flora is not yet thoroughly worked and it is a pleasure to record that the discovery was made by two members of the Mountain Club of South Africa, Messrs. T. P. Stokoe and R. Primos, both of whom have previously also collected interesting plants from the mountains of the Cape Province.

Protea aristata, Phillips (Proteaceae—Proteae) ; *a P. revoluta R. Br. calycis laminis aristatis differt.*

Rami glabri. *Folia* 5—7 cm. longa, 0·2 cm. lata, linearia, apice sub-acuta, mucronata, glabra. *Capitulum* sessile, 7·5 cm. longum, circiter 4 cm. latum. *Involucri-bracteae* 15—17-seriatae ; exteriores ovatae, obtusae, glabrae ; interiores lineari-spathulatae, supra 1·2 cm. latae, sparse pubescentes, calyci longiores. *Calycis tubus* 2·2 cm. longus, basi vix dilatus, 7-nervosus, ciliatus, glaber ; laminae 9 mm. longae, apice longe aristatae ; aristae 1·2—1·8 cm. longae, supra apice ciliatae. *Stamina* 3, fertilia, subsessilia, 8·5 mm. longa, linearia, apice glandibus 1 mm. longis linearis obtusis instructa ; stamen sterile 1. *Ovarium* 1·5 mm. longum, pilis longis vestitum ; stylus 1·4 cm. longus, linearis ; stigma 6 mm. longum, lineare, plano-convexum, 1-costatum.

Cape Province : Prince Albert district : Seven Weeks Poort on open slopes facing north ; branches trailing on ground ; outer bracts dark red ; inner bracts pink ; perianth pink ; 5,200 ft ; December, 1928 ; *National Herbarium* 23015 (type), *Stokoe* 1882, *Primos* 85.

Protea aristata Phillips. FIG. 1. Portion of plant (life size). 2. median longitudinal section of head. 3. Upper portion of perianth, showing the long awns, the 3 fertile stamens and the staminode. 4. An anther. 5. Stigma.

NOTES ON THREE SOUTH AFRICAN TERRESTRIAL UTRICULARIAE.

(With Plate 11.A.)

By Edith L. Stephens.

I. Utricularia capensis Spreng., with Utricularia Ecklonii Spreng.

In the "Flora Capensis" these small species, both originally described by Sprengel, are separated in the key to the genus by the size of the corolla (3—5 lin. long in *U. capensis* and 2—2½ lin. in *U. Ecklonii*), and in the specific descriptions further differences appear in the degree of lobing of the lips of the corolla and the length of the spur. These are illustrated in Hooker's "Icones Plantarum" (plates 2793 and 2794).

Examination of a large number of living specimens has shown that "typical" specimens of *U. capensis* generally grow in wet or consistently damp spots, and "typical" ones of *U. Ecklonii* in places that are drier or only intermittently wet. In those taken from localities of an intermediate character, it is often very difficult to decide between the two species. This suggested the possibility of the apparent differences being due merely to environment, and the desirability of testing this by experiment.

At the end of September, 1934, several clumps of typical large-flowered *U. capensis* were collected on the Zuurvlakte, 40 miles north of Ceres. These clumps were kept growing under "wet bog" conditions for two months, and continued to produce typical-sized flowers, so that it was evident there was no admixture of *U. Ecklonii*. Similarly a patch of *U. Ecklonii* from the Cape Flats was taken and kept under observation in the dampish sand of its habitat, and remained typically small-flowered.

On November 27th the two sets of flowering clumps were placed side by side in water in a shallow tray, the water being changed twice a week. The flowering season was now ending, so the experiment was kept going till the next season. Precautions were taken to prevent any stolons from one species penetrating a clump of the other, and all fruits formed were either removed before ripening or else pushed down into the soil of their own clumps before the seeds were shed.

The plants had not flowered again before the end of June, 1935, and as I left then for Europe, Mrs. M. R. Levyns very kindly took charge of the experiment. Both sets of plants flowered well in September and October, and she reported that there was now little or no difference in the size of inflorescences and flowers—certainly no specific difference. She also preserved flowers from the two sets, and these I have examined in detail. No difference could be found between them. Moreover both sets resembled the " control " flowers of *U. capensis* which had been preserved for comparison from the clumps of that species before the start of the experiment. The only difference from these flowers was in size, those from the experiment being for the most part slightly smaller than the originals, due no doubt to the artificial cultural conditions. But they still reached the minimum measurements for *U. capensis*, and all corresponded exactly to the description and figures of the species.

From this it may be inferred that *U. Ecklonii* is a growth-form of *U. capensis*, found in drier conditions or in places of a more variable water-content than the typical *U. capensis*. The description of the two species should therefore be combined under *U. capensis*, and *U. Ecklonii* sunk in that species.

II. Utricularia brachyceras Schltr.

In the Flora Capensis (vol. 4, section 2, p. 431) Stapf gives the following note after his account of " *U. Ecklonii* " : " Schlechter, in Engl. Jahrb. XXVII. 191, described *Utricularia brachyceras*, collected by him on Pakhuis Mountain, at 2,500 ft. (No. 8601 !). It seems to be an exact parallel to *U. capensis*, var. *brevicalcarata*, Oliv.,* and to stand in the same relation to *U. Ecklonii*, as that variety to *U. capensis*, viz. as a short-spurred sport. The same state was also collected by Drège near Ellenbogenfonteinsberg, together with an almost normal long-spurred form."

Stapf figures Schlechter's plant (Ic. Pl. 28, Pl. 2793, fig. 14) under *U. Ecklonii* as " Flower with short-spurred corolla (*U. brachyceras*, Schlecht.)." This figure shows the form of the upper lip of the corolla and the spur correctly, but the position of the lower lip is incorrect, for it is shown deflexed as it sometimes appears in the dried material, instead of horizontal as in life.

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* Unfortunately Drège's short-spurred specimen from the Giftberg (Drège 7884) on which Oliver bases this variety is not accessible in South Africa, nor is the one from Ellenbogenfonteinsberg also mentioned above by Stapf; and as Oliver makes no mention of the character of the stigma—the decisive diagnostic character of *U. brachyceras*—I cannot give an opinion as to the identity of either.

After examination of copious living material of plants from the type locality of *U. brachyceras*, which I have compared with the type specimens, I am convinced that it is quite distinct from *U. capensis* (including *U. Ecklonii*). Schlechter's description is inadequate and does not extend beyond the corolla, thus omitting the distinctive characters of the stigma, viz. (i) the abortion of one lip, (ii) the much greater development of the other than in *U. capensis* (cf. plate 11A, fig. 10, with Ic. Pl. 2794, fig. 8). This is the most critical point of distinction between the species. As it is probable his description was made from dried material, the following more detailed description is given :

Utricularia brachyceras Schlechter.

U. capensis Sprengel affinis sed corolla alba, calcare brevissimo, et stigmatis labio supero abortivo, labio infero ligulato vel obovato differt.

Herba terrestris, perpusilla, inter muscos in solo humido reptans. *Stolones* tenuiter filiformes vel capillares ; folia, utriculi, et rhizoidea e stolonibus orta. *Folia* secundum stolones sparsa, ad pedunculorum bases subrosulata ; lamina anguste linearis vel fere teretia, obtusa, in petiolum longe attenuata, cum petiolo ad 1 cm. longa, 0·5 mm. lata. *Utriculi* e stolonibus foliisque orti, ovoideo-globosi, 1 mm. longi, basi breviter stipitati. *Flos* solitarius. *Pedunculus* filiformis, strictus vel leviter flexuosus, 2—4 cm. longus, bracteis vel bracteolis 2—3 minutis prope stipitem positis. *Sepala* persistentes ; superum obovato-orbiculatum, concavum, circa 0·75 mm. longum (in typo " vix 0·2 cm. diametiente " dictum, sed errante) ; inferum ovatum, leviter concavum, circa 0·5 mm. longum. *Corolla* alba, praeter labium superum lineis paucis purpureis leviter notatum et labii inferi palatum luteum, 3 ad 4 mm. longa ; tubo 0·25 mm. longo ; calcar rotundatum, ad 0·5 mm. longum ; labium superum erectum, obovatum vel cuneato-obovatum, 1·25 ad 1·5 mm. longum, emarginatum vel plus minusve 2-lobum ; labium inferum late patens, flabellatum, marginibus undulatis, undis crispatulis, circa 3 mm. longum latumque, palatum laeve, subbigibbosum. *Filamenta* curva, filamentum 0·25 longum, antherae breviores contiguae. pollinis granum globosum, longitudinaliter vittatum, 22 μ dimetiens, *Stylus* 0·1 mm. vel brevior, complanatus ; stigmatis labium superum absens, labium inferum late ligulatum vel obovatum, apice rotundato, persistens, primo leviter inflexum, deinde reflexum, 0·5—0·8 mm. longum. *Capsula* fere globosa, parum longior quam lata, 1—1·25 mm. longa, dehiscens primo longitudinaliter post sepalum anterius, deinde irregulariter. Semina lenticularia, 0·25 mm. diam., tenuiter irregulariterque reticulata.

Hab. Cape Province, Clanwilliam Division, Pakhuisberg, Aug. 1896, R. Schlechter 8601 ! Pakhuis Pass, Sept. 1937, E. L. Stephens 2002 !

This attractive and very distinct species was found on Sept. 21, 1937, close to the outspan on Pakhuis Pass. It was growing on a gentle rock-slope, in moss through which water was oozing, and was sheltered by an overhanging rock. Such ideal conditions for a terrestial bladderwort must be rare in that rather dry region, and no similar spot could be found in the time available. Schlechter collected his specimens " in saxosis humidis, in monte Pakhuis-Berg, alt. 2,500 ped." This is the altitude of the Outspan, and it is possible that he may have collected from the same spot.

The general appearance of the flowers suggested a cloud of tiny snow-flakes settling on the moss. These white flowers and the very short spur distinguish it at a glance from all other South African terrestrial bladderworts. From its nearest ally, *U. capensis*, it is further distinguished by the absence of an upper stigma lip and the well-developed ligulate or obovate lower stigma lip. (The term " stigma lip " is used in conformity with the " Flora Capensis " on this genus.)

Description : A delicate, very dwarf, terrestrial herb, with finely filiform or capillary stolons which creep among moss on wet soil and bear leaves, bladders and occasional rhizoids. *Leaves* scattered on the stolons, but at base of peduncle usually 2 or 3 together ; lamina narrowly linear or almost terete, obtuse, very gradually attenuated into the petiole, including petiole up to a centimetre long, and up to 0·5 mm. broad. *Bladders* borne on stolons and on leaves, ovoid-globose, a mm. in length, with a short stalk at basal end. *Peduncle* filiform, straight or slightly flexuose, 2 to 4 cm. long, simple except in scape formed by germinating seed, which may form one or two others from its base (fig. 2). *Flower* solitary with 2 or 3 minute oval bracts or bracteoles just below it. *Sepals* united at base, persistent, becoming separated by enlargement of fruit ; upper sepal obovate-orbicular, concave, about 0·75 mm. long ; lower ovate, slightly concave, about 0·5 mm. long. *Corolla* creamy-white except for several delicate mauve or violet lines running down the upper lip and a yellow flush on the palate of the lower lip, 3 to 4 mm. long ; tube 0·25 mm. long ; spur rounded, up to 0·5 mm. long ; upper lip erect, obovate or cuneate-obovate, 1·25 to 1·5 mm. long, margin undulating, emarginate or more or less bilobed at the apex, lower lip about 3 mm. long and broad, carried horizontally, margin frilly, palate smooth, slightly 2-gibbous. *Stamens* with curved filaments and contiguous anthers ; filaments 0·25 mm. long, anthers shorter than filaments ; pollen-grain globose, longitudinally vittate, 22 μ in diameter. *Style*

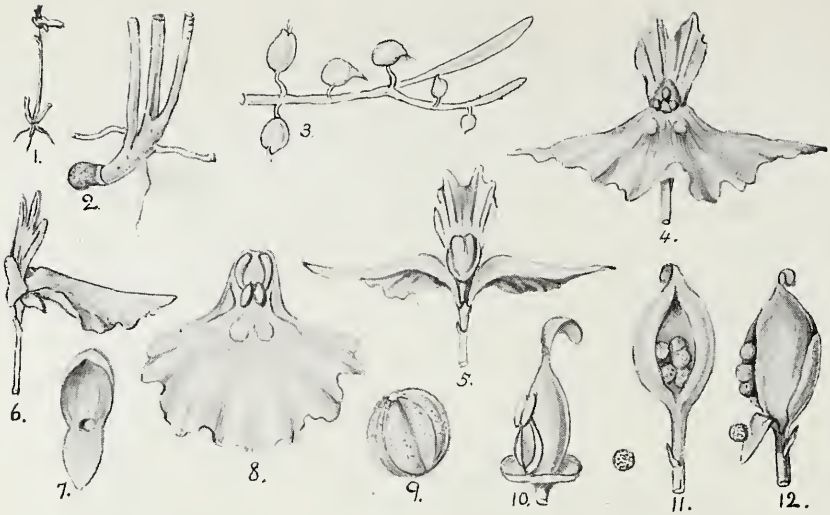


PLATE 11.A.

1. *Utricularia brachyceras*. Plant life size. 2. Base of scape formed directly from germinating seed, showing three peduncles, stolon, a rhizoid, and seed-coat still attached × 16. 3. Stolon with leaves and bladders × 8. 4. Front view of flower × 15. 5. Back view of flower × 15. 6. Side view of flower × 10. 7. Calyx from above × 15. 8. Lower lip of corolla and stamens × 10. 9. Pollen gram × 600. 10. Pistil and stamens × 24. 11. Dehiscent capsule, front sepal removed × 20. 12. Dehiscent capsule, front sepal deflexed × 20.

(*Del.* B. Carter,)

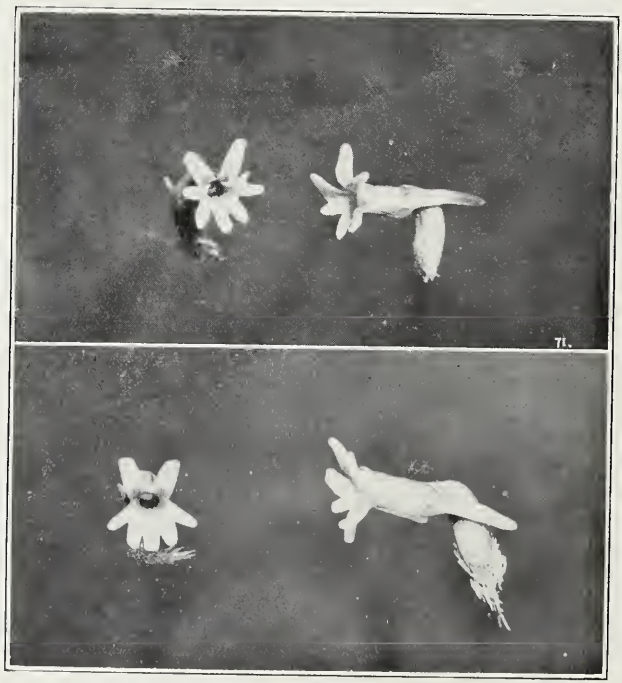


PLATE 11.B.

Holothrix longicornu, Lewis. Four views of the flowers, × 3½, showing the 5-lobed lip, glabrous sepals and long, straight spur. (*Phot.* W. Y. Cutting.)

very short, 0·1 mm. or less, flattened in same axis as stigma ; upper stigma-lip entirely absent ; lower broadly ligulate or obovate, apex rounded, persistent, at first slightly curved forward, later reflexed, 0·5—0·8 mm. long. *Capsule* almost globose, slightly longer than broad, 1—1·25 mm. long, opening first in the median line behind anterior sepal, later often further dehiscing irregularly. *Seeds* lenticular, 0·25 mm. in diameter, finely and irregularly reticulate.

No details of the bladder are given in the above description, as seeds have been sent to Professor F. E. Lloyd in the hope that he may be able to grow the plant and add another to his fine series of studies on the vegetative morphology of this genus. The material described was collected during a University Botanical expedition organised by Professor Compton, to whom I am indebted for the opportunity afforded. My thanks are also due to Miss B. Carter for the trouble she has taken over the accompanying drawings, made from living plants, and to Mrs. Bolus for her kindness in reading through this paper in manuscript.

Botanical Department,
University of Cape Town.
February, 1938.

NEOHENRICIA.

By L. Bolus, D.Sc.

Neohenricia L. Bolus, nom. nov.—*Henricia* L. Bolus (*Mesembryanthemaceae*), nom. invalidum quia **Henricia** Cass. prius publicata est. **Neohenricia Sibbettii** L. Bolus, comb. nov.—*Henricia Sibbettii* L. Bolus.

A NEW ORCHID.

By G. J. Lewis.

(With Plate 11.B.)

Holothrix longicornu Lewis. (Orchidaceae—Ophrydeae.)

H. squamulosa Lindl. affinis sed calcare fere stricto longioreque, sepalis glabris, differt.

Plantae 8—24 cm. altae ; tubera oblonga vel ovoidea. *Folia* 2, carnosa, pilis crebris deflexis mollibus brevibus vestita, majus suborbiculare, 1·7 cm. longum, 2·5 cm. latum, alterum fere cordatum, acutum, 1·5 cm. longum, 1·3 cm. latum. *Inflorescentia* multiflora, 20—22-fl., 3·5—5·5 cm. longa. *Flores* minuti viridi lutei, leviter suaveolentes. *Bractea* ciliata 3 mm. longa. *Sepala* glabra, apice tamen minute ciliata, connata, 2 mm. longa. *Petala* 5 mm. longa, 1 mm. lata, labio 5-lobato, lobis subaequalibus obtusis 1·5 mm. longis, circa 1 mm. latis. *Calcar* 5·5 mm. longum, strictum vel apice leviter curvatum. *Ovarium* contortum, 5·5 mm. longum.

Hab. Port Elizabeth. W. Y. Cutting No. H. 69 (in Bolus Herbarium). Oct., 1937.

Living plants of this small Holothrix were sent to the Bolus Herbarium in Oct. 1937 by Mr. W. Y. Cutting of Port Elizabeth, a keen collector and cultivator of Orchidaceae in that district. It is nearest to *H. squamulosa*, Lindl., but differs in having a longer and nearly straight spur and glabrous sepals.

Description : *Plants* 8—24 cm. high ; tubers oblong or ovoid. *Leaves* 2, fleshy, the larger sub-orbicular, 1·7 cm. long, 2·5 cm. broad, the other nearly cordate, acute, 1·5 cm. long, 1·3 cm. broad, both covered with numerous retrorse, soft hairs. *Stem* slender, pilose, the hairs retrorse, white. *Inflorescence* many-flowered, 3·5—5·5 cm. long, 20—22-flowered. *Flowers* very small, greenish-yellow, having a faint, sweet scent. *Bract* ciliate, 3 mm. long. *Sepals* glabrous but minutely ciliate at apex, fused, 2 mm. long. *Petals* 5 mm. long, 1 mm. broad ; lip 5-lobed, lobes subequal, obtuse, 1·5 mm. long, about 1 mm. broad. *Spur* 5·5 mm. long, straight or slightly curved at tip. *Ovary* twisted, 5·5 mm. long.

TWO NEW ACACIAS OF ZULULAND.

By Rev. J. Gerstner, Ph.D., O.S.B.

Acacia grandicornuta Gerstner, species nova, Acaciae robustae, Burch. affinis. *Arbor* circiter viginti pedibus alta, forma tamquam pirus. *Cortex* canus, fissis multis directe ad perpendiculum praeditus. *Truncus* circa 30 cm. diam. *Ramuli* striati et verrucosi. *Stipulae* spinescentes. *Spinae* directae, albidae, 0·2—1·1 × 0·5—15 cm., nonnumquam basi confluentes. *Folia* circ. 4 × 7 cm., foliola vel pinae 1—4 paribus, pinnulae 8—15 paribus 1·5—2 × 5—8 mm., oblongae, apice et basi rotundatae, minutissime pubescentes supra subterque non solum in statu florenti sed etiam frugifero. Inter par pinnarum ultimarum semper, inter par pinnarum proximarum nonnumquam sunt glandulae, velut catilli. *Flores* 4—12 in fasciculo axillari globosi. *Capita* 6—8 mm. diam. minora capitibus Acaciae robustae (10—15 cm. diam.) colore lacteo. *Flosculi* calice et corolla glabra lobataque. *Filamenta* circiter 50 elongata, lactea. *Pollinia* ovalia basi apiceque cordato sunt lutea. Legumen fuscum, falcatum, circa 12 venis conspicuis longitudinalibus reticulatum, simile legumini Acaciae robustae sed gracilius 8 × 80 mm. Legumen Acaciae robustae collectum in eodem loco 16 × 120 mm. Semina 7 × 12 mm., 3—5 in legumine pulla et ovata.

Hab. Natal and Zululand : Flowered 6.1.36 at Emkunzana and Mkuzi Drift between Nongoma and Magut, Gerstner 2870. Fruits found at the same places and at the lower Pongola 13.5.36.

"*Acacia grandicornuta* Gerstner" is named in accordance with the Zulu name, "umZingampondo," which means "sight of horns." In shape it closely resembles a Pear tree and is closely related to *Acacia robusta*, Burch., which is called in Zulu "umNgamanzi." The latter has a denser foliage and is more umbrella or, rather, Apple-tree-shaped. *Acacia robusta* grows, as the Zulu name indicates ("the umuNga of the water," umuNga being the name for *Acacia karroo* and *Acacia natalitia*) always near the water, whereas *Acacia grandicornuta* being more xerophilous, is found some distance from water on hills of dry bushveld. The white spines are 0·2—1·1 × 0·5—15 cm.

Primary leaves about 4 × 7 cm. are sometimes amalgamated with the bases of the spines, if the latter are fused and inflated (cf. Fig. 1 B). The secondary leaves which are of similar size, originate as spurs or fascicles of 3—5 leaves from prominent cushions in the axils of the

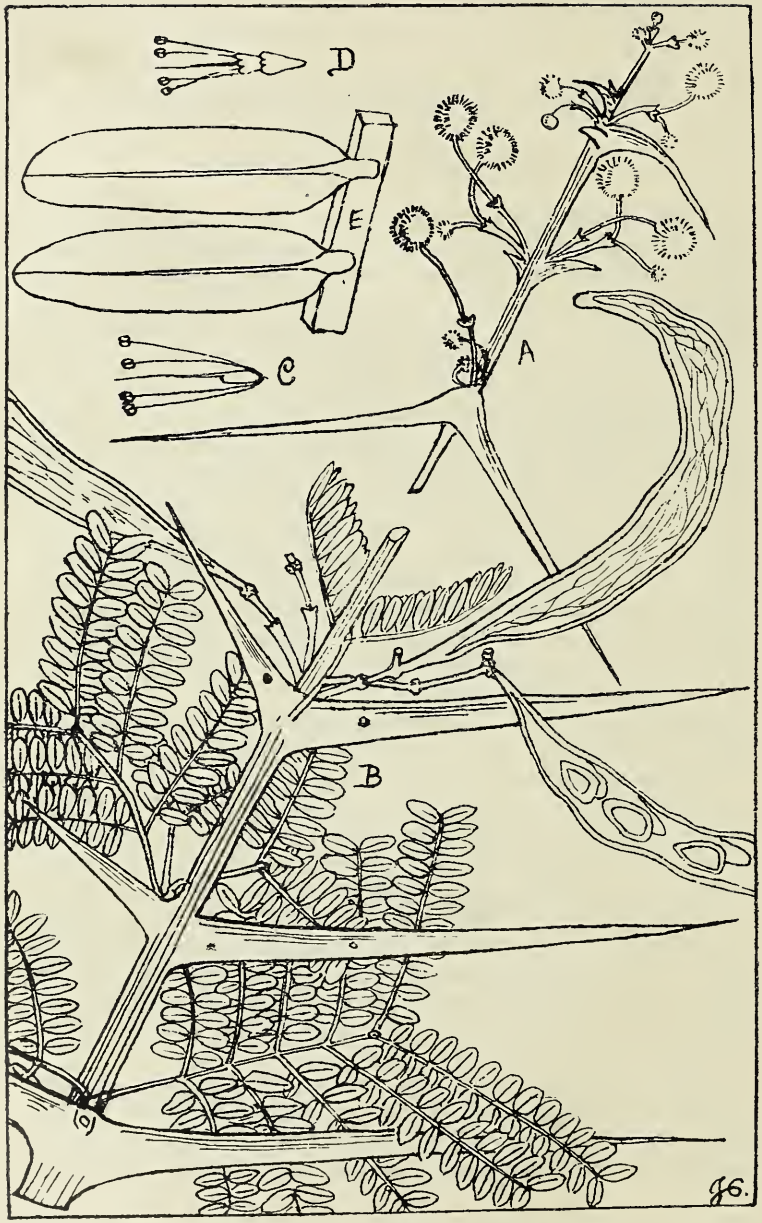


Fig. 1. *Acacia grandicornuta*. A, a flowering branch, nat. size; B, a branch with fruits, one pod open and showing arrangement of seeds, nat. size; C, ovary with style and a few stamens × 7; D, single flower with only a few stamens left × 7; E, two pinnules × 7.

primary leaves. The petiole in flowering state is about 10 mm. and, in fruiting state, about 18 mm. long. The pinnae-spacing is at first 6—8, later on 8—10 mm. Rhachis 3—4 mm. long with 1—4, usually 3 pairs of pinnae. Apical pair, sometimes the next ones, with interpetiolar saucer-shaped gland between. Rhachilla with 8—15 pairs of pinnules. Pinnules oblong 1·5—2 × 5—8 mm. (cf. Fig. 1. E × 6), minutely puberulent *on both sides*. In the latter characteristic it is unlike *Acacia robusta*, which is only puberulent in the early flowering stages and later on becomes glabrous and even glossy above. Lateral veins of pinnules mostly wanting, sometimes 2—4.

Inflorescences are 4—12-fasciculate, globose, creamy-white flower-heads of 6—8 mm. diam. and replacing partially or totally the secondary leaves of the axillary spurs, which originate from prominent cushions. Involucel more or less at the middle of the slender, glabrous peduncle (cf. Fig. 1 A.). Calyx and corolla are whitish and glabrous outside. The stamens (about 50) are whitish-cream ; the anthers pale yellow (cf. Fig. 1 C and D × 7). The brown subwoody, falcate legume is 8 × 80 mm. and therefore more slender than that of *Acacia robusta*, the pods of which are usually 16 × 120 mm. On each side of the pod a bundle of about a dozen conspicuous nerves start at the cuneate base and end in the bill-like apex ; they diverge and fuse again at distances of 5—10 mm. thus forming a longitudinally directed network of veins. The seeds, 3—5, circ. 7 × 12 mm. are glabrous, blackish brown and ovate.

Acacia barbertonensis Schweickerdt.

This species has been recently described (in Kew Bull. 1937 p. 445) by Dr. H. G. Schweickerdt from the Barberton District of the Transvaal and from the Inkuzane River in Zululand. I have also collected it in Zululand at Mkuzi Drift (9th Jan. 1936, and in fruit 15th March 1936 : Gerstner 2871), and have found it also at the lower Ntambamana River near the Umhlatuze.

The Zulus call this Acacia " uBibi " and " uSagu." The latter name is used for the nearly-related Acacia Natalitia as well.

Acacia barbertonensis is usually a multi-branched shrub, doing well in very dry and hot bushveld of northern Zululand. All the branches, leaves and even fruits are covered above and below with numerous little glands, which make the whole shrub glutinous like *Acacia glandulifera*. It differs from the latter by the much smaller leaves and the pods which are similar to those of *Acacia Natalitia*. The branches are ribbed. Pure vegetative twigs have secondary leaves in fascicles or spurs. The very slender spines are white and 1·1—1·5 × 5—35 mm. The leaves are circa 30 × 60 mm. The petiole is about 7—10 mm. long. The pinnae-

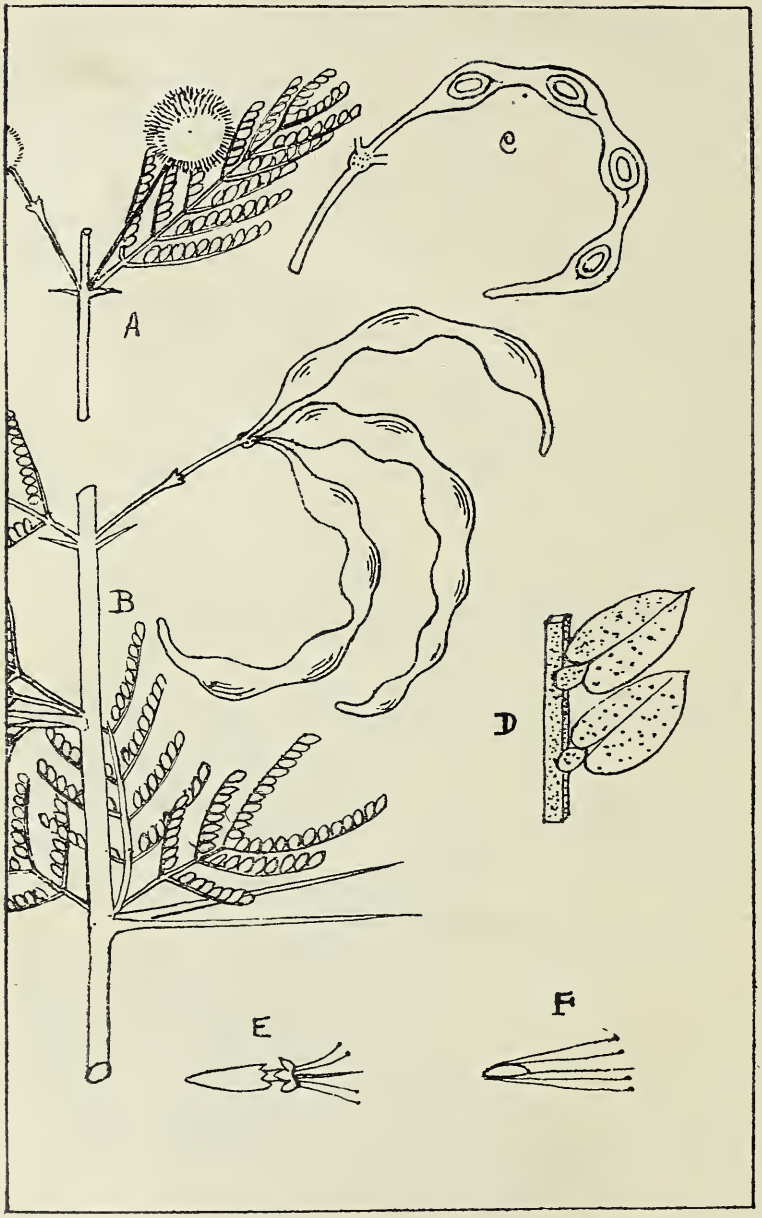


FIG. 2. *Acacia barbertonensis.* A. a piece of a flowering branch, nat. size; B, a branch with fruits; C, one pod open and showing arrangement of seeds, nat. size; D, two pinnules × 10; E, single flower with only a few stamens left × 4; F, ovule with style and a few stamens × 4.

spacing is 3—7 mm. The rhachis is polygonal and has 1—8, usually 6 pairs of pinnules. The rhachilla of the pinnules is quadrangular and has 8—12 pairs of cordate pinnules (cf. Fig. 2 B & D), 0·75—1·5 × 1·3—3 mm.

The deep yellow, globose, flower heads, 12—15 mm. diam. are arranged similarly to those of *Acacia Natalitia*, being collected at the ends of the branchlets into panicles mixed with leaves : as there are usually only two flowers in an axil, the inflorescence is not as dense as in the case of *Acacia Natalitia*. The glutinous involucel is more or less at the middle of the slender and viscid peduncle (cf. Fig. 2 A). The whitish calyx and the yellow corolla are glabrous and lobate. The numerous (about 50) stamens and anthers are also yellow, the oblique ovary green (cf. Fig. 2 E. & F.). The reddish brown, nervose glutinous pod is about 80 mm. long, the width of the slender, torulose legume varying from 2—6 mm. (cf. Fig. 2 B.). The 4—6 seeds of a pod are oval, 3·5 × 5 mm. and greenish grey (cf. Fig. 2 C.). Dr. J. S. Henkel is describing perhaps this species partially in his book " The Woody Plants of Natal and Zululand " as a possible hybrid between *Acacia karroo* Hayne and *Acacia glandulifera* Schinz. But as *Acacia barbertonensis* occurs at the Umhlatuze, i.e. about a hundred miles away, where I found the next *Acacia glandulifera*, it cannot be a mere local hybrid (cf. Henkel p. 229). Dr. Schweickerdt also doubts Dr. Henkel's suggestion in the absence of definite evidence, and believes that *A. barbertonensis* is specifically distinct.

NOTES ON SOME CAPE SPECIES OF ANNESORHIZA.

By R. S. Adamson.

The genus *Annesorhiza* was founded by Chamisso and Schlectendahl (Linnaea I. 398, 1826) who included in it a single species *A. capensis* of which the leaves were not known. In 1837 Ecklon and Zeyher (Enum. 344-5) added six new species while including *A. capensis* Ch. & Schl. in their list. In elaborating the genus for the Flora Capensis (II. 545, 1862) Sonder retained these seven species and added one more. In later times four further species have been added but these, though they extend the range of the genus to the Transvaal, do not occur in the extreme South-western Cape and are not further considered. Examination of material in the field and in herbaria shows that the original eight require some rearrangement.

A. capensis Ch. & Schl. was fully described (l.c. 399) though without leaves. Sonder (Fl. Cap. II, 545) described the leaves as " . . . *lobes spreading lanceolate subulate* "; a description which is not justified by the specimens in his herbarium which have been examined. The species is there represented by three sheets not one of which has a complete leaf. One specimen has a petiole with indications at its top of a trifid division and is glabrous. The others are leafless. In each case the base of the stem is enclosed in a ring of fibres derived from old leaves. These sheets are marked "*A. capensis* Cham. & Schlecht." in Sonder's handwriting. It seems either that Sonder was describing material other than that in his herbarium or that his description is inaccurate. No recent collections attributed to this species have been seen which possess any leaves.

Ecklon and Zeyher's species *A. montana* is a well characterised plant fully represented in collections. In Sonder's herbarium are specimens collected by Ecklon and Zeyher and by Drège. These plants and others in various herbaria are quite indistinguishable from Ecklon and Zeyher's specimens of *A. capensis* Ch. & Schl. Further as far as can be seen the latter had glabrous leaves and specimens of *A. montana* E. & Z. show stem bases surrounded by fibres. Indeed there seem no characters by which the two species can be separated. The difference in fruit size made use of by Sonder is not a valid one : the fruits in two specimens of *A. capensis* in Sonder's herbarium measured $5 \cdot 5 \times 3$ mm. and $7 \cdot 5 \times 2 \cdot 5$ mm. In *A. montana*, which is said to have larger fruits, a number of

measurements gave as extremes 4 × 2 and 8 × 3 mm. with an average of 4·5 × 2·5 mm. Taking all the facts together it would appear that the two names really apply to the same plant which should be called *A. capensis* Ch. & Schl. It should be added that the original type-specimen of *A. capensis* collected by Bergius has not been seen. *A. capensis* is perennial.

Of the other species *A. hirsuta* E. & Z. is a distinct and easily recognisable plant. It is a stouter and taller plant than *A. capensis* Ch. & Schl. with hairy leaves, few or no fibres at ground level, terminal umbels with 2—4 most commonly 3, long and stout rays. *A. capensis* has 3—7 slender and shorter rays to the umbel. The involucral bracts in *A. hirsuta* have white margins and the fruit is larger, 7 × 3 mm.

A. elata E. & Z. is a closely allied plant which is not represented in any recent collections. In Sonder's herbarium are three sheets, two of Ecklon and Zeyher and one by Wallich and Hartman. All are leafless. The specimens are much like *A. hirsuta* and only differ in being more slender and in having 4—5 rays in the primary umbel. *A. elata* seems certainly not really separate from *A. hirsuta* and should be sunk in that species.

As additional support for the reduction to two species, *A. capensis* Ch. & Schl. and *A. hirsuta* E. & Z., instead of four, examination of the material variously named in Sonder's collection, in the herbaria at Kew, British Museum, S. African Museum, University of Cape Town and the Bolus Herbarium, shows a clear separation of two species and two only.

A. macrocarpa E. & Z. is readily distinguished from either of the foregoing by its glabrous leaves with small crisped parsley-like segments, umbels with 6 or more rays, and larger fruits with more pronounced wings on the ridges. The closely allied *A. spuria* E. & Z. differs in being taller and more robust, in much more numerous umbel rays and larger fruits. Sonder, while including it, treated *A. spuria* as a doubtful species. Till recently when the plant was rediscovered at Camps Bay this species was only known from Ecklon and Zeyher's specimen collected at Doornhoogde. The original plant was leafless but the Camps Bay plant which is otherwise identical with Ecklon and Zeyher's has leaves that exactly match those of *A. macrocarpa* E. & Z. The leaves in this species wither away completely before the maturation of the flowers.

Apart from size the chief character of *A. spuria* is the many rayed umbel: Ecklon and Zeyher's plant has 24 rays, the Camps Bay one 21, whereas specimens of *A. macrocarpa* range from 6—15. Some of the plants of the latter have fruits as large as those of the typical *A. spuria* (e.g. Burchell 4790 in Herb. Kew). A careful examination of all the

available material and more especially of the collections of Ecklon and Zeyher suggests very strongly that *A. spuria* is merely a very strong vigorous state of *A. macrocarpa* E. & Z. and is not really separate. The name *A. macrocarpa* E. & Z. is retained for the united species because it is fully described and was taken up by Sonder whereas the original description of *A. spuria* is short and incomplete.

Of the remaining species very little is known. *A. villosa* Sonder is represented by a specimen collected by Drège at Ezelbank. This has the general habit of *A. capensis* but has densely hairy leaves. *A. filicaulis* E. & Z. is represented in Sonder's herbarium by a single leafless incomplete specimen collected at Clanwilliam. It has some almost mature fruits which suggest that the plant may be a *Peucedanum*.

The eight species in Flora Capensis thus reduce to four with well differentiated characters. *A. capensis* Ch. & Schl., *A. hirsuta* E. & Z. and *A. macrocarpa* E. & Z. occur on the Cape Peninsula.

In conclusion I have to thank Mr. C. Norman for his help and criticism during the course of this work. I also desire to thank the Keeper of Botany, British Museum, who obtained for examination the material in Sonder's herbarium, and the Director of the Botanical Museum, Stockholm, for the loan of those sheets.

Note.—The generally accepted spelling *Annesorhiza* has been adopted though *Anesorrhiza* might seem more correct. The name is a latinisation of "Anys Wortel" (Anise Root) which was the old vernacular name applied to the plants.

A PROPOSED DELIMITATION OF BOTANICAL COUNTIES FOR SOUTHERN RHODESIA.

By H. B. Gilliland,

Botanical Department, University of the Witwatersrand.

In the study of the flora of a region in the Herbarium, where specimens, together with the collector's notes and records in literature, form the chief source of information about the habitat and communities in which a plant lives, the student is not infrequently exasperated by a record such as "Rhodesia," often not even accompanied by a date.

That there is little, however, to guide a collector, particularly one with a purely amateur interest in plants, must be admitted. The present paper aims therefore to define more particularly the information desired about plants collected in Southern Rhodesia with a view to facilitating studies of their geographical distribution and ecology.

In making the following suggestions I am guided by the practice of British botanists, which is founded on the work of Watson (1), followed by the several London Catalogues (2) and Reports of Botanical Clubs (3), which in their totality constitute periodic checks on nomenclature and a vast source of geographical information. Much useful and interesting information about the geographical origin and relation to climatic change of the British Flora has emerged from this careful record (*cf.* Mathews, 4.)

While such an "Ecological Flora" as is envisaged by Salisbury (5) is undoubtedly the ideal, it is felt that much more must be known even of the floristics of Rhodesian plants before such could be attempted.

This paper suggests 17 Botanical Counties for Southern Rhodesia as follows :—

1. **The Victoria Falls.** Limits : The boundaries of the Victoria Falls Game Reserve.

   This area is predominantly one of umGusi and Mopani, but also includes the highly atypical Falls area with its small piece of Rain Forest. This area, one of the chief tourist attractions of Southern Rhodesia, has been visited perhaps by more botanists and collectors than any.

2. **The Kalahari.** Limits : The Zambesi to the west of the Falls Reserve ; the Bechuanaland Border down as far as the Bulawayo-

Francistown railway ; that railway to Bulawayo ; Bulawayo to the Falls by rail.

The area is predominantly one of semi-desert sand veld with a fair mixture of vegetation types such as Mopani, Mfuti, umGusi, Msasa, Thorn, Mangwe and grassland. Very little collecting has been done here with the exception of work by Mr. A. H. Pardy.

3. **Matabeleland.** Limits : The Kalahari to Bulawayo ; Bulawayo to Somabula by rail ; Somabula to Shabani by rail ; Shabani to the Lundi river due east ; the Lundi river to Chiburubute ; Chiburubute to Tuli by Selous road ; Tuli along the Shashi to the border ; the border north-west to the Kalahari.

   The chief vegetation types are Mopani, Msasa, Mangwe, thorn and grassland.

   The north-western area of this county, containing Bulawayo and the Matopos, has been visited by as many collectors as the Falls, notable among whom are Mr. F. Eyles, Archdeacon Rogers and Dr. F. Rand.

4. **The Limpopo.** Limits : The Limpopo valley ; Matabeleland ; Chiburubute down the Lundi river to the Chipinda Pools ; thence along the line of 1,000 ft. altitude to the Limpopo.

   The chief vegetation types are Mopani and Msasa. There are no collections, apart from some casual gatherings in passing by Dr. Pole Evans, from this area.

5. **The Sabi.** Limits : County (4) as far as the junction of the Lundi and Chiredzi rivers ; along the Chiredzi to Zaka ; Zaka by road, through Bikita, to the Fort Victoria-Birchenough Bridge road ; the road east to the Birchenough Bridge ; the Bridge south along the Sabi to the junction with the Tanganda river ; the Tanganda river to branch south, passing west of Chipinga along the track to the Umxilixiwe river at the border ; the border south and west to Limpopo county.

   An area predominantly of Mopani and Mfuti with some Msasa. Apart from a casual collection by Swynnerton this area too is unworked.

6. **Gazaland.** Limits : County 5 to the Birchenough Bridge ; the Bridge along the Sabi to its junction with the Odzi ; the Odzi river to its junction with the Wengezi river ; the Wengezi river to the border ; the border down to Sabi county.

   This area, so well reported on by Swynnerton and the British Museum (6), contains part of the eastern escarpment and shows an interesting altitudinal zonation into Mfuti, Msasa and Mountain zones. The mountain zone contains both grassland and

evergreen mountain forest, while the well-known mahogany forest of Mt. Selinda belongs here.

7. **Umtali.** Limits : Gazaland ; the border as far north as the Christmas Pass range ; from the Christmas Pass by road to Tsungwesi ; south along the Tsungwesi river to the Sabi ; the Sabi river south to its junction with the Odzi river at County 6.

   As interesting a region vegetatively as the last but with less high ground and quite a large stretch of Mopani. Swynnerton, Teague, Eyles and many others have collected here.

8. **Manicaland.** Limits : Umtali county ; by road from Tsungwesi to Rusapi ; Rusapi to Inyanga by road ; Inyanga due east to the Gaerezi river ; the Gaerezi to the Border ; the Border south to county 7.

   As interesting a region as the last two and having in Mt. Inyangani the highest point in S. Rhodesia. There is no Mopani.

   This region has been the focus of attention for some time past, having been worked by Prof. Thor. E. Fries and his associates, Eyles, Henkel, Pardy and the present author.

9. **Mtoko.** Limits : Manicaland ; Rusapi by road to Macheke ; Macheke north by road to Mrewa ; Mrewa to the Mohuni river ; the Mohuni river to its junction with the Mazoe river ; the Mazoe river to the border ; the border south to county 8.

   This is largely low-lying country containing Msasa, Mfuti and Mopani. I know of no collections from this area.

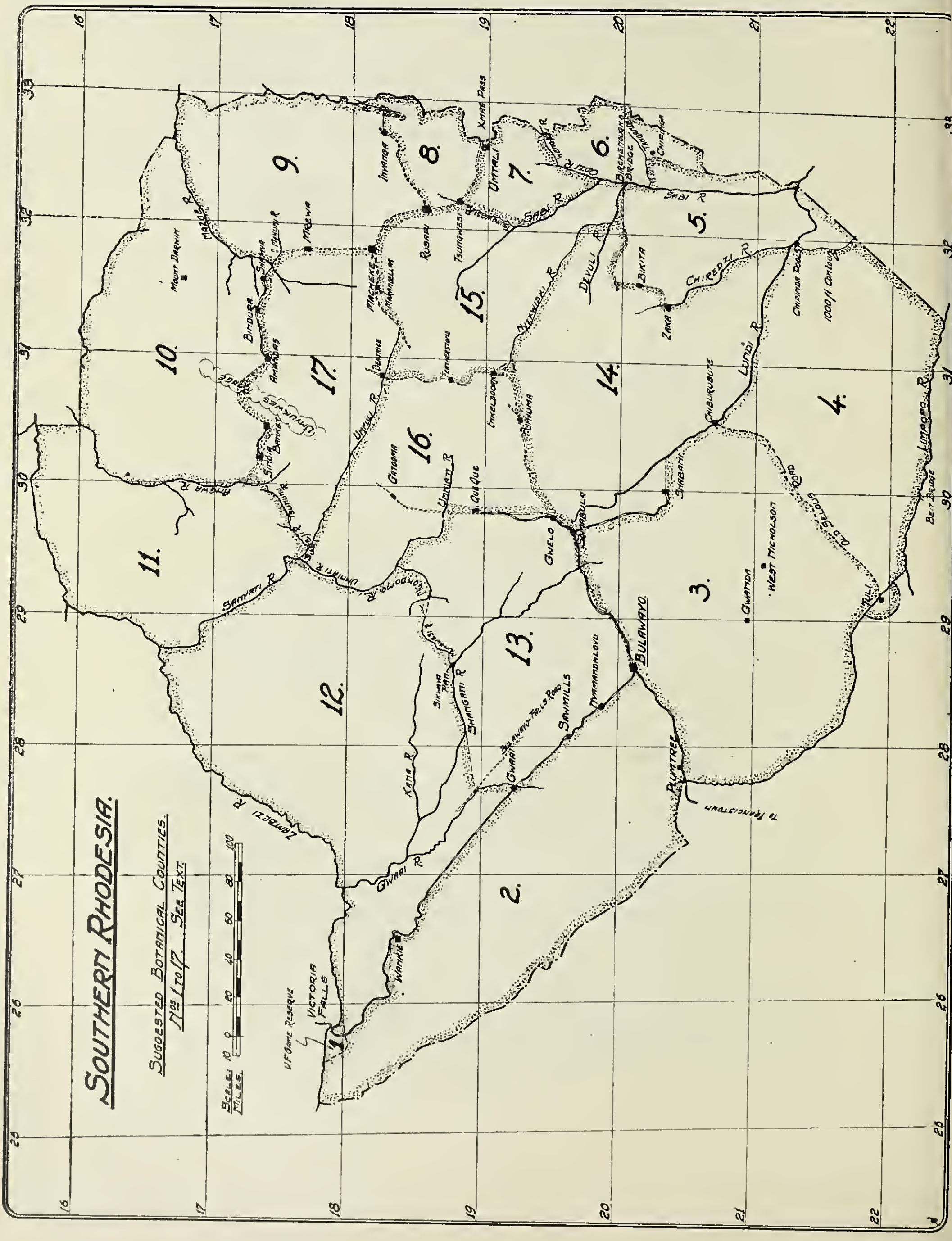
10. **Darwin.** Limits : Mtoko county ; the Mohuni river to Shamva ; Shamva by rail to Amanda ; Amanda by road across the Umvukwes to Banket ; Banket by rail to Sinoia ; Sinoia by road to the Angwa river ; the Angwa river to the border ; the border to county 9.

    Again chiefly low-lying and consisting of Msasa, Mfuti and Mopani. The Umvukwes bear grasslands and many interesting eastern border plants occur at higher altitudes (7). Systematic collections are here wanting also.

11. **The Lower Zambesi.** Limits : Darwin county ; the Zambesi west to its junction with the Sanyati ; the Sanyati river to its junction with the Suseji ; the Suseji to its junction with the Tsununu ; the Tsununu river across to the Angwa ; down the Angwa river to county 10.

    Low-lying country with Msasa, Mfuti and Mopani. Dr. F. Rand made a fairly large collection from Miami here.

12. **The Upper Zambesi.** Limits : Lower Zambesi county ; the Zambesi to county 1 ; Kalahari county as far south as Gwaai ; from


Southern Rhodesia.
Suggested Botanical Counties.
Nos 1 to 17. See Text.
Scale: Miles.
10 0 20 40 60 80 100
Victoria Falls
Wankie
Gwabi R.
Zambezi R.
Bulawayo
Gwelo
Umtali
Sabi R.
Limpopo R.
Lundi R.
Chiredzi R.
Devuli R.
Umfuli R.
Sanyati R.
Plumtree
Gwanda
West Nicholson
Beit Bridge
Zaka
Bikita
Rusapi
Macheke
Gatooma
Que Que
Sinoia
Banket
Bindura
Shamva
Mount Darwin
Mazoe R.
Mrewa
Inyanga
Xmas Pass
Birchenough Bridge
Chipinga
Enkeldoorn
Chibi
Shabani
Sawmills
Nyamandhlovu
Shangani R.
Kana R.
Bulawayo-Falls Road
Old Selous Road
Chipinda Pools
To Francistown
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
16 17 18 19 20 21 22
25 26 27 28 29 30 31 32 33

Gwaai down the Gwaai river to the Bulawayo Falls road ; from the road due east to the Shangani river ; the Shangani river to the Sikwaya Pan ; Sikwaya Pan along the Mungwasi to its source ; east to the Mgondomo river to county 11.

This area is more broken than the last and contains the Umgusi as well.

Mr. F. Levy, of Wankie Collieries, has made some fine collections here.

13. **Shangani county**. Limits : Kalahari county and the Upper Zambesi ; the Umniati from county 12 to the Gatooma-Queque road ; Queque by road through Gwelo to Bulawayo.

A very mixed area containing Mopani, Mfuti, Umgusi, Msasa, Thorn and Mangwe.

A few casual collections come from this area.

14. **Karangaland.** Limits : Shangani county ; Matabeleland ; Limpopo ; Sabi ; from Birchenough Bridge along the Nyzxwidxi river to Moffat road ; along Moffat road to Umvuma ; Umvuma to Gwelo by road.

Another mixed area but without the umGusi.

Large collections were made here by Munro and many casual collections have been made by visitors to Zimbabwe.

15. **Charter.** Limits : Karangaland ; Sabi ; Gazaland ; Umtali ; Manicaland ; Mtoko ; Macheke to Marandellas by road ; Marandellas to Beatrice ; Beatrice to Karangaland through Enkeldoorn by road.

Mixed vegetation containing Mangwe as well as the Brachystegias and Mopani.

No collections have been made here to my knowledge.

16. **Gatooma.** Limits : Charter ; Karangaland ; Shangani county ; Upper Zambesi ; Lower Zambesi ; Beatrice along the Umfuli river to county 12.

Vegetation the same as 15 without Mopani and with Muhatja.

Only casual collections have been made here.

17. **Mashonaland**. Limits : Gatooma ; Charter ; Mtoko ; Darwin and lower Zambesi counties.

Perhaps the most interesting and varied of the counties, containing all types with the exception of the Mountain forest and with by far the largest number of species as yet recorded. A large number of collectors have worked here, prominent among them being Mr. F. Eyles, whose report (8) is still the most complete record of Rhodesian plants.

See the outline map on the opposite page.

More and more attention, of recent years, has been focussed both by the botanist and his numerous colleagues primarily concerned with more obviously economic problems, on the phenomena of plant and animal ecology. Here too the worker in comparing and reviewing areas of the same region finds the essential information desired to be lacking in the published and herbarium records.

Dr. Henkel (9) has published an account of the Rhodesian vegetation, which the writer has found to be accurate in the field, and which can serve as a useful further guide to define the plant's associates. This will be an essentially "natural" addition inasmuch as the vegetation types noted by Henkel correspond to a large degree to the climatic variations induced primarily in Southern Rhodesia by varying topography within the general east to west differentiation of rainfall.

If the 17 Botanical Counties enumerated above can be accepted it is further suggested that a standardised minimum notation should accompany each specimen collected, thus :

(1) County ; (2) Vegetation type ; (3) Immediate associates ; (4) Notes ; (5) Locality ; (6) Date.

e.g.

Widelia natalensis Oliv. & Hiern.

S. Rhodesia ; Manicaland ; in Mfuti type, in association with Uapaca nitens and U. Kirkiana ; Shrubby ; Flowers lemon yellow ; iNyumquarara valley. Feb., 1935.

or

Adansonia digitata Linn.

S. Rhodesia ; Limpopo ; Mopani type ; In association with Mopani especially on rocky slopes ; Large tree with a rounded crown of leaves and thick squat trunk ; in fruit ; near Mazunga ; April, 1934.

It is felt that, particularly from the ecological point of view, records of animals might profitably be made on the same basis, thus e.g. :—

Rhampholeon marshalli Blgr.

S. Rhodesia ; Manicaland ; In climax evergreen forest ; climbing over the branches of a small tree well under the canopy ; Ziwani forest ; July, 1937.

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The writer wishes to acknowledge most gratefully the assistance of Mr. P. R. Swart in drawing up the Map.

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VOL. IV.

THE VEGETATION OF RHODESIAN MANICALAND

(With Plates 12—35)

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I. Summary of previous work.

Rhodesian vegetation, even in very general terms, remained unknown until well into the 19th century; the accounts of previous explorers being vague and usually anecdotal. Thus, although Kirk and Meller (Oliver, 1868) when attached to Livingstone's first and second expeditions and Peters (1863) in a journey to Mocambique and the Zambesi valley had made collections just north and east of Rhodesia as early as 1860, it was not till 1881 (Oates, 1881) that the first account of a Rhodesian collection appeared. From that time collections began to come in, most of which are quoted in vol. iv and onward of the Flora of Tropical Africa (23). In 1911 appeared the first account of a piece of Rhodesian vegetation, when the collections and explorations of C. F. M. Swynnerton were reported on in the Journal of the Linnaean Society of London. (Rendle, 1911.)

Swynnerton collected and explored chiefly in the region known traditionally as Gazaland, and, of that, chiefly the Rhodesian portion. He did not clearly distinguish between the dominant communities and types, but his records are very full and usually enable one to assign due place in the vegetation to the species he records.

Eyles' work (1916), while materially benefitting the study of vegetation, necessarily omitted all but the briefest reference to plant communities, and it was not till 1931 that a comprehensive account of the vegetation types in Southern Rhodesia appeared from the pen of J. S. Henkel, then Chief Forest Officer (Henkel, 1931). Including an excellent map of the distribution of the vegetation types, this paper was of generous scope and forms the sine qua non of further vegetational studies. Ten major vegetation types were recognised.

Further systematic investigations were carried on by Thor C. E. Fries and his associates, particularly round Mt. Inyangani (Weimarck, 1932). The unfortunate death of Fries curtailed the field work, but the collections continue to be named from Lund.

II. Definition and Political History of area.

The area of Rhodesian Manicaland has been defined in a previous paper (Gilliland, 1938).

The name, like that of Gazaland, is a traditional one, though it has become less used in more recent times. Its origin is lost in antiquity (Hole, 1926), the earliest records being of one Vasco Fernandes Homen to the gold diggings of Manica in the sixteenth century, when, as far as is known, it was a province of the legendary Empire of Momomotapa.

At the time of the British Occupation, after Mashonaland had been occupied by the Pioneer Column in 1890 under the Rudd Concession,

Rhodes sent Colquhoun to treat with Umtasa, a chief, resident east of the Sabi river and beyond the influence of Lobengula's impis, and endeavour to obtain a similar concession from him. This he did successfully and thereafter Umtasa's territory came under British Protection. This treaty was worded " a treaty or alliance made between the Manica nation and the Government of Queen Victoria." From this and from the fact that the dialect spoken is termed chiManyika, the boundaries may be taken as roughly those of the sphere of influence of the present Umtasa in what is now British Territory.

III. Inhabitants.

(*a*) **Present.**—The region is at present inhabited by European settlers, confined for the greater part to the near neighbourhood of the main roads and townships. The number of them cannot greatly exceed a thousand.

Together with the European settlers, there are their farm labourers, mostly native, and a large population of natives in native reserves ; the Makoni, Manyika, Umtasa north, Umtasa south and Manga reserves with a population of about 10,000.

(*b*) **Past.**—That Stone-Age Man inhabited the whole of the continent at some time in the past is the opinion generally held amongst prehistorians. (Theal, 1910 ; van Riet Lowe, 1937 ; Holmes.) Although we may feel certain that stone-age Man was familiar with fire, the present central African pygmies and the remnants of the Bushmen—not cattle-owning peoples—suggest that he was not concerned in the destruction of forest for grazing or hut-building purposes. Such destruction was probably first caused by the iron-age (Bantu) migration from the north. The Hottentots are generally held (Theal, 1910) to have migrated down the west side of the continent, and thus do not come into the picture here. The time of the first iron-age migration across the Zambesi is usually put at no more than a thousand years ago (Theal, 1924). Subsequent to the time of the first migration there is much evidence of habitation in the form of " slave pits " (Mason, 1933) and the van Niekerk ruins in Manicaland. These dwellers are survived or were followed by the present inhabitants.

Thus for a period extending over perhaps one thousand years people have been present in this region, acquainted with, and commonly using, fire and axe to destroy woody vegetation in favour of pasture and arable land.

IV. Geology of the region (Phaup).

(*a*) **Schists.**—Practically the whole of the rocks in Manicaland are of Precambrian age, the oldest belonging to the Archaean Basement Schists

of Rhodesia, which are probably equivalent to the Swaziland System of South Africa. They form a long narrow belt stretching over 70 miles in a west-south-westerly direction from just north of Umtali past Odzi, to the Sabi Native Reserve beyond the Sabi river. Where the belt crosses the border, it is about 5 miles wide and is composed of two marginal lines of hilly country separated by a broad valley of comparatively flat country. The marginal hills are formed of serpentine and talc-schist derived from ultrabasic rocks, and greenstones formed from basaltic rocks. These rocks are more highly metamorphosed than the younger sedimentary rocks, chiefly arkoses, greywacke and phyllites which form the flatter central portion of the belt. Towards the west the belt of schists narrows to about a mile across and the greenstone and serpentine hills converge to meet near the Odzi river, and from there westwards they compose the whole belt.

(*b*) **Granites.**—By far the greater part of the district is composed of massive and gneissic Precambrian granodiorite, known locally as granite. It is younger than the basement schists and is intrusive into them and in many places contains large half-digested inclusions of schist which colour the soil red locally.

(*c*) **Sandstone.**—In the northern part of Manicaland near Inyanga is a strip of flat bedded sediment about 35 miles long and 5 miles wide. In many ways this resembles the Umkondo System sediments of the Melsetter district, and is probably of the same age as the Waterberg sediments farther south.

(*d*) **Dolerites.**—Intrusive into all the above are large dykes and sills of dolerites of uncertain age. They occur everywhere but are best known around Inyanga and the railway line, where they form patches of rich, red clayey soil known locally as " diorite " soil.

V. Topography.

Rhodesia consists in the main of a plateau at an average altitude of ± 4,500 ft. bounded in the north and on the south by the deep river valleys of the Zambesi and Limpopo respectively. The plateau falls rather steeply to these two valleys which constitute the main drainage channels of the country. On the west the plateau falls slowly into the Kalahari desert, and on the east rises somewhat steeply to the eastern escarpment which has an average altitude of about 5,300 ft., but with peaks rising to 9,000 ft.

Manicaland consists of a portion of the plateau more or less triangular in shape. The apex lies at Rusape and the base is formed by the escarpment running from the Xmas Pass, north of Umtali, along

the Inyanga Range and containing two peaks of note in Mt. Nuza, 6,666 ft. and Mt. Inyangani, 9,000 ft. Finally there is the narrow portion on the east, dropping down to 2,000 ft. within five miles in some places, which merges into the adjoining Portuguese Plain.

VI. Drainage.—There are two main watersheds in the area :—

(*a*) **The Escarpment.**—This runs approximately north and south, and the rivers drain from it in both easterly and westerly directions. Draining east are the Numkwarara, the Honde and the Pungwe rivers. The Numkwarara and Honde join the Pungwe which flows into the Indian Ocean at Beira.

Draining north-east is the Gaerezi river flowing into the Ruwenya and then the Mazoe which ultimately joins the Zambesi.

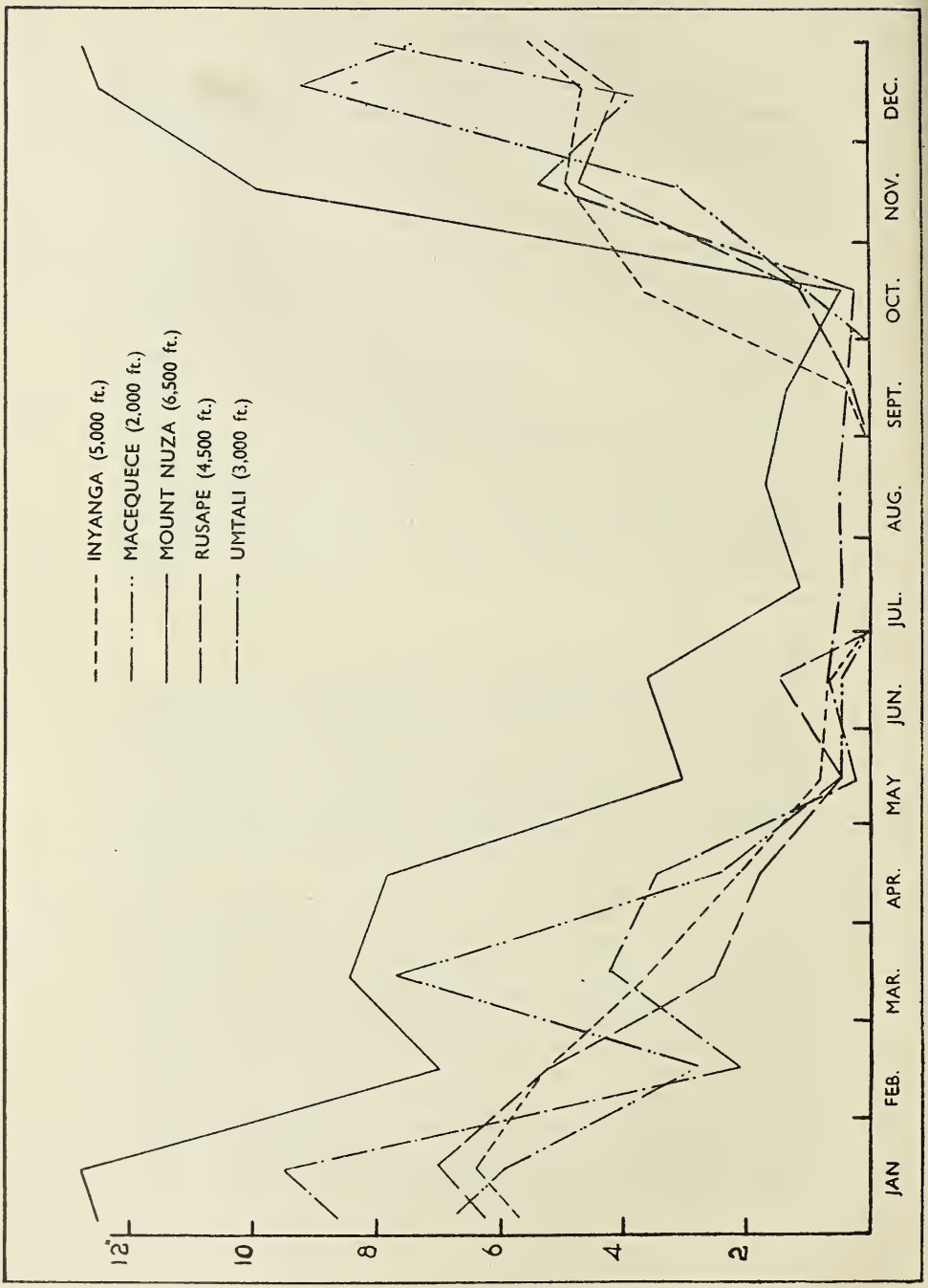
Draining west are the Odzani and Chinyika rivers.

(*b*) **The Plateau.**—The plateau, which is part of the general Rhodesian plateau, acts as a watershed between the Zambesi and Limpopo drainage systems, and while we find the Odzani turning south to flow into the Sabi, which drains into the Indian Ocean somewhat north of the Limpopo, the Chinyika turns north and east to flow into the Gaerezi and thence into the Zambesi.

VII. Climate (25).

The meteorological records from several stations within the region, together with some others from neighbouring stations, have been examined. Those for the year 1934 are analysed in the form of graphs (figs 1—4). These data may be taken to represent the general climate, though figures for other years may differ in detail. It will be seen that as might be expected, mean maximum and mean minimum temperatures decrease with increasing altitude and that rainfall and relative humidity increase with increasing altitude. The position of the station in relation to the escarpment, however, should be carefully borne in mind. Thus Mt. Nuza is on the summit of the escarpment. Umtali likewise but at a very much lower altitude, Macequece to the east and Inyanga and Rusape to the west of the escarpment. The climate is thus seen to be fairly uniform with rain-bearing winds blowing from the east. Differentiation is, in general, in terms of altitude and distance from the escarpment to the west.

Three " seasons " can be generally distinguished, a hot wet " rainy season," a cool dry " winter season " and a hot dry " spring season." To the west of the escarpment at Rusape a further dry warm " autumn season " is beginning to be differentiated.


INYANGA (5,000 ft.)
MACEQUECE (2,000 ft.)
MOUNT NUZA (6,500 ft.)
RUSAPE (4,500 ft.)
UMTALI (3,000 ft.)
12°
10
8
6
4
2
JAN
FEB.
MAR.
APR.
MAY
JUN.
JUL.
AUG.
SEPT.
OCT.
NOV.
DEC.

VIII. The Vegetation.

(A) Introductory.—Within this region, and indeed elsewhere in Rhodesia, Henkel's map has been found to be accurate (Henkel, 1931).

The vegetation falls naturally into three zones, as it stands at present, corresponding to mean annual temperature differences of about 5 degrees. These differences are directly traceable to altitude.

Differentiation is further caused, west of the escarpment, by a progressively smaller rainfall in the westerly direction, and had Manicaland extended much further west than Rusape, a further climatic zone would probably have had to be discussed. As it is, this slow lessening of the rainfall from east to west makes the distinction between the three zones on the west face of the escarpment anything but definite.

While classical phytogeographic papers have been content to describe the vegetation as at present in situ (Clements, 1902 ; Engler, 1908), the trend to-day is to interpret existing vegetation in terms of genetic relationship to that ultimately possible under the prevailing climate. Such an ultimate vegetation is termed a **climax.** Much patient field study, on the continents of America amd Africa particularly, has shown (Clements, 1904, 1916 ; Phillips, 1931) that the climax is conditioned only by the climate, and that the other vegetation types present should be interpreted as developmental or **seral** to the climax. In general three major **seres** are recognised ; from moist sites or the **hydrosere** ; from arid sites or the **xerosere** and from disturbance of the climax or secondary succession stages. The further nomenclature for the more or less stable stages in the vegetation prior to the climax or relict from a previous climate is given by Clements (1936). The ideas inherent here are discussed later in this paper.

The Three zones noted above are :—

i. **The muPfuti Zone.** Lying between 2,000 ft. and 3,500 ft.
ii. **The muTsatsa Zone.** Lying between 3,500 ft. and 5,000 ft. (±).
iii. **The Mountain Zone.** Land above ±4,500 ft.

(B) The muPfuti Zone. (*Brachystegia spp. of B. flagristipulata type.*)

This is the smallest zone in terms of area and occurs in two portions :

(1) **West of the escarpment.**—To the west of the escarpment it forms a belt about five miles wide in the valley of the Tsungwesi, turning north-east to terminate at a point almost due north of Odzi. Meteorological records are unfortunately not available for this area, the nearest in similar vegetation being many miles to the north-west at Mt. Darwin.

(2) **East of the escarpment.**—On the eastern side of the escarpment the muPfuti is found along the eastern border as a narrow strip, scarcely three miles wide, as far south as Mt. Panga and extending up into the

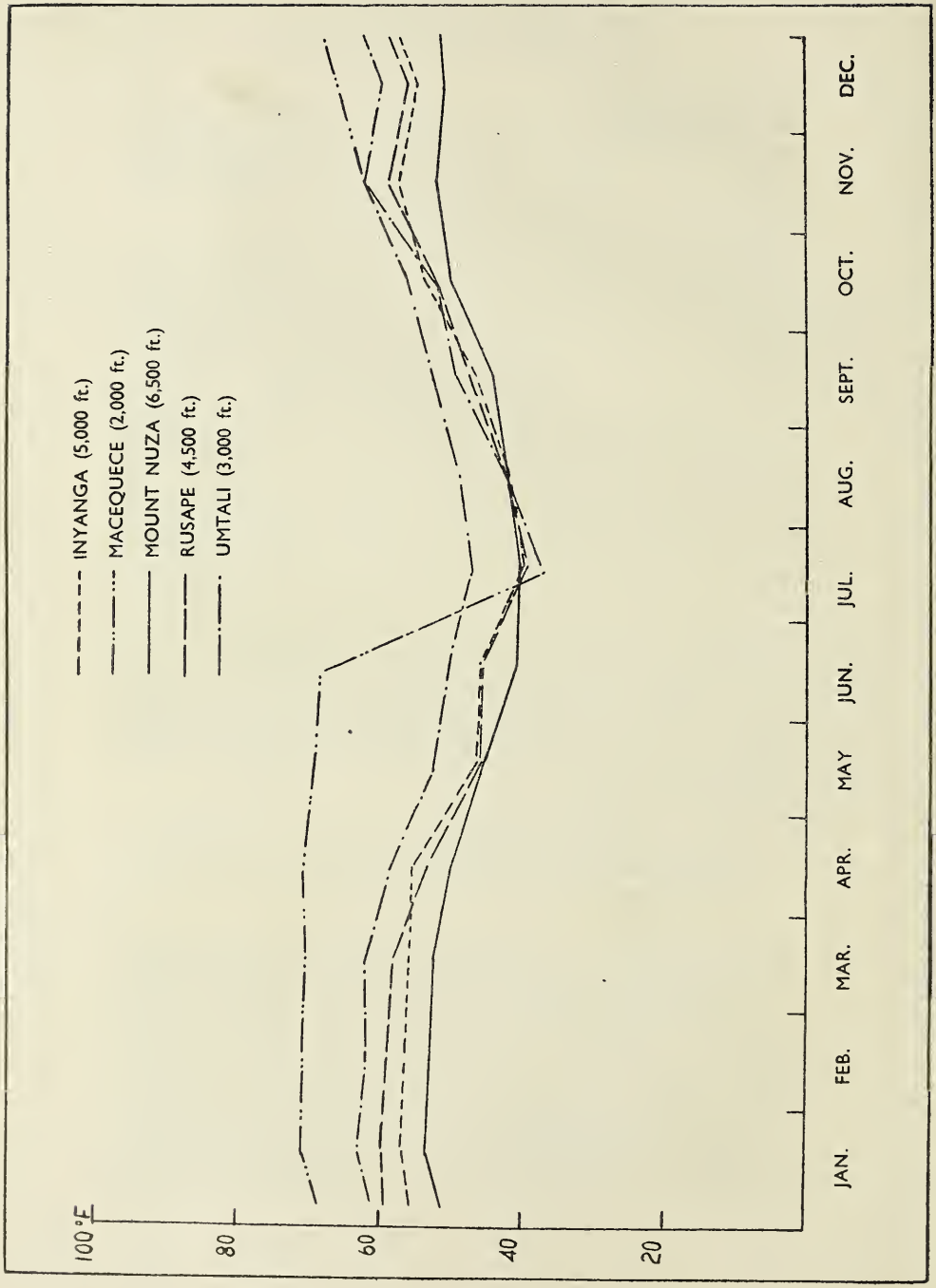


Fig. 2.—Graph showing the variation of relative humidity with locality and season in Manicaland.

valleys of the Pungwe, Honde and Numkwarara. Again unfortunately there is no meteorological station, but figures are available for Macaquece about 20 miles east of Umtali.

Biotic factors.—Man. In the Honde and Numkwarara valleys dense native populations exist. These carry on a kind of "shifting agriculture." Tree-bearing land is felled and burnt over and subsequently cultivated by hoe and cropped until the soil is exhausted. New tree-bearing land is treated similarly and the old left. That fire (probably man-made) has been active for a long period of time, as noted by Henkel, is indicated by the numerical preponderance of fire-resisting trees. The succession following on native cultivation is noted below.

Animals. Adequate animal studies were not made. There can be no doubt however that mammals and birds play an important part in the development of vegetation here, chiefly through distributing seed.

Chief communities and succession.

i. **The Climax.**—Taking into consideration the fire-resistance, open canopy, ability to thrive on rocky immature soils and potential deciduousness of the muPfuti, one feels satisfied that the open savanna type of woodland, of which it is characteristic, is not a climax vegetation in this area. Particularly is this conclusion emphasised by an examination of the riverine vegetation which frequently develops into evergreen, storied forest. It is suggested that the climax is evergreen forest of tropical type, such as is noted for the muTsatsa zone, of definite structure and with the genus *Khaya* as a prominent member. Unfortunately the writer has not been able to discover such a climax forest type in Rhodesia or in Portuguese East Africa in a comparable climatic zone, nor is there reference in literature to one. Perhaps the forest of the Amatongas in Portuguese East Africa may be a relic of just such a type, but this needs confirmation. (26.)

ii. **Present communities.**

Primary succession.—Primary succession stages, other than those directly related to the hydro- or xero-seres, are not easy to find. Perhaps the *Albizzia* dominated forest of small stature on the northern slopes of the Pungwe-Honde confluence represent such a stage.

Secondary succession.

The pioneer forb-short grass stage.—This is a series of communities on old lands and other disturbed areas. Occasional geophytes are present such as *Pentanisia variabilis*, with numerous species of grass, sedge and others, e.g. *Panicum*, *Eragrostis*, *Perotis indica*, *Pogonarthria squarrosa*, *Cyperus*, *Bulbostylis*, *Phyllanthus*, *Oxalis*, *Biophytum*, *Triumfetta*,

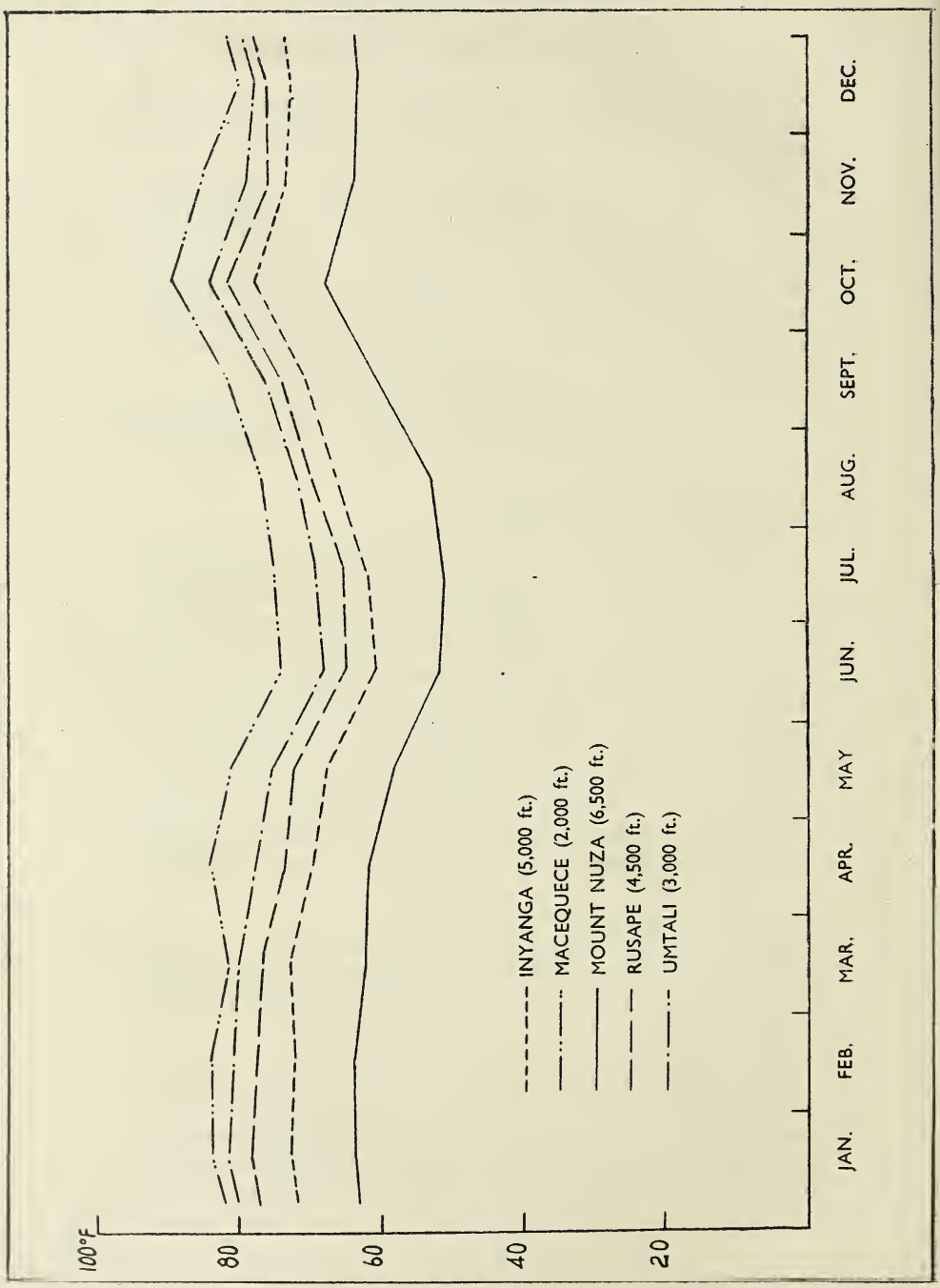


Fig. 3.—Graph showing the variation of mean maximum temperature with locality and season in Manicaland.

etc. *Cynodon* and other creeping grasses are absent so that much bare ground is visible.

The Tall grass stage.—The above is succeeded by a series of tall grass communities (Plate 12.*a*) with their associated plants. *Hyparrhenia gazensis, H. hirta, Setaria* and *Pennisetum* are prominent.

The first tree stage.—The period occupied by the preceding stages is short and they are followed quickly by the invasion of the

(*a*) **muJanje—muTongoro stage.**—This stage is very common on the valley plains and is particularly connected with native cultivation. It consists sometimes of almost pure stands of *Uapaca Kirkiana* (muJanje ; Plate 12.*b*.) but more often of a mixture of *U. Kirkiana* (Plate 13.*a*.) and *U. nitida* (muTongoro; Plate 13.*b*.) These trees are fairly short, rarely exceeding 35 ft. in height, with a straight trunk, branching above in the manner of an umbrella, to form a flattish crown, the leaves being bunched at the ends of the branches. The bark and foliage are fire-resistant to a high degree. (Specimens felled and burnt over quite commonly coppice.) The trees bear edible fruit which is much fancied by Man and Baboon alike, with the result that the seed is widely distributed. (Mute evidence of this last is to be found in the association of the muJanje with native paths in both the muTsatsa and muPfuti zones.)

The tree very quickly invades the grass stage (Plate 14.*b*.) —or recuperates by coppicing from the rigours of fire and axe (Plate 14.*a*)—and is very fast growing, soon forming dense stands with a poor associated grass and shrub flora. The native practice, sufficient of these having now become established through long habitation of the valleys, is now to fell and burn muJanje for new lands in preference apparently to any other stage. From this it follows, and is borne out in practice, that invasion of muJanje is rare and difficult to find—a sort of rotation being established.

The associated plants of this community are:—*Indigofera spp., Borreria dibrachiata, Psychotria, Widelia abyssinica, W. natalensis, W. nemotricha, Vernonia leptolepis, Lightfootia abyssinica, Antidesma venosum, Phyllanthus petandrus, P. glaucophyllus, Scirpus, Scleria Buchanani, Mariscus sieberianus, Brachiaria brizantha, Digitaria, Sporobolus, Themeda triandra* (rare) and *Trichopteryx*. Of these the last-named is present in greatest quantity.

(*b*) **The muOnga stage.**—With a poorer grass flora, though much richer shrub flora, is the muOnga stage. (muOnga = thorny plant,

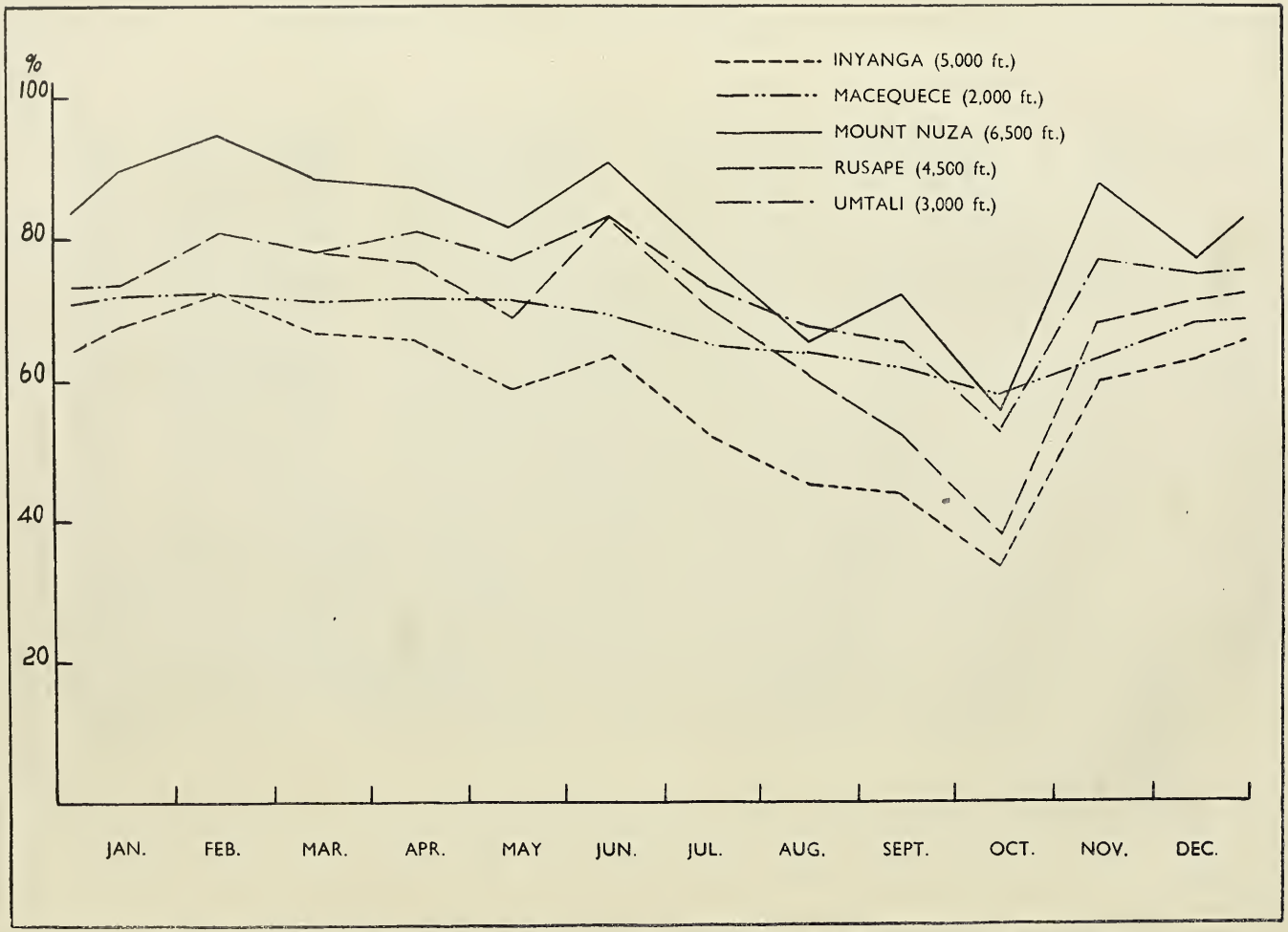


Fig. 4.—Graph showing the variation of mean minimum temperature with locality and season in Manicaland.

e.g. *Acacia spp.* and *Dichrostachys glomerata.*) The origin of this community is not clear, though obviously depending more than the above on the proximity of a seed source, since the fruits are chiefly pods, not berries. The community is predominately one of small trees and large shrubs (10-20 ft. high, e.g. above and *Randia vestita*). The natives do not, as a rule, cut and burn this, probably on account of the abundant thorn. Several tall invaders were noted, particularly the muGaranyense (*Burkea africana*).

The Tall tree stage.—The period occupied by the preceding stages is probably not very long, say 50—100 years. They are succeeded by a tall tree stage of which two types were noted :—

(*a*) **The muChakati.**—The muChakati (*Parinarium*) (Plate 15. *b*) dominates over small areas and occasional very large specimens up to 60—80 ft. are to be noted in muJanje communities. The tree reaches a height of 100 ft. and has a large round crown of leaves. The fruit is eaten by the natives and baboons. This community was probably among the first selected by the natives to cut, burn and cultivate. muChakati in process of invading an earlier stage is difficult to find and was not observed by the writer.

(*b*) **Later stages.**—In favoured sites, sheltered by natural topography or for other reasons free from fire, fairly old specimens of *Afzelia* and *Pterocarpus* (chiCundambira), together with the muGaranyense and a rich undergrowth of shrub and forest grass occur.

The Hydrosere.

General.—The usual aquatic plant-sedge-rank grass stages are to be observed (e.g., *Podostoms* (Plate 15. *a*), *Hydrostachys-Cyperus-Setaria, Pennisetum* and *Hyparrhenia*). The dominant trees are *Adina microcephala, Pterocarpus* and *Afzelia* on the deeper, more mature soils. The muPfuti is present here on rocky sites.

Secondary stages.—Most native cultivation, other than of mealies, sorghum and sesamum, is on vlei or semi-vlei soil (e.g., Rhapoco, Rice, Pumpkin, Gourds and Sweet potatoes). Here the pioneer community is one of *Polygala, Corchorus, Cissus, Amarantus chlorostachys, Celosia trigyna, Cyperus, Fuirena, Pycreus angulatus, P. macranthus, Setaria aurea*, etc. This is followed by a rank grass community (Plate 16. *a*) commonly completely dominated by *Hyparrhenia cymbaria. Imperata cylindrica* occasionally forms an outer zone when burning is the only disturbing agent.

Rainy season facies.—A " rainy season " facies common to all stages of secondary succession prior to the rank grass stage consists of annuals and ephemerals such as *Commelina*, *Lobelia*, *Oxalis* and *Biophytum*.

The xerosere.

(*a*) **Pioneer stages.**—The usual lichen-pioneer-grass-succulent community (Plate 16. *a*, foreground) is here, containing *Stapelia variegata*, *Ilysanthes*, *Torenia spicata*, *Aeolanthus* and numerous Orchids. The unusually large number of the latter associated with the lithosere in both the Honde and Numkwarara valleys is noteworthy. A large community of epiphytes, mainly Orchids, should probably be also included here, though it forms an integral structural part of the tree stages.

(*b*) **The muPfuti stage.**—This stage is confined to rocky and immature soils (Plate 16. *a*, background). It is to be placed here in the final stages of the xerosere before the transition to the climax vegetation. Two trees are noticeable, the one the muPfuti proper of Manicaland, *Brachystegia flagristipulata* (Plate 17. *a*), on the wetter and warmer sites, and the Narwatsi, which is *Brachystegia utilis* (Plate 17. *b*) on the drier and cooler spots. As the raw rocky soils are by far the commoner in this zone the trees are numerically preponderant. The muTsatsa invades down into this zone along the streambanks, the abundant and easily available water probably compensating for the greater heat. Where soils have become more mature the later stages of the mesosere invade. Except for the greater preponderance of shrubs and perennials the accompanying vegetation differs little from the muJanje-muTongoro community till the muPfuti itself is being invaded.

(C) The muTsatsa Zone. (*Brachystegia spp. of B. Randii type.*) This zone lies roughly between 3,500 ft. and 5,000 ft. The lower limit is fairly well defined to the east of the escarpment, but the upper limit and the limits to the west of the escarpment are very difficult to determine with similar accuracy (Weimarck, 1932). The zone is by far the largest in area in Manicaland and, just as with the muPfuti is divided by the escarpment into western and eastern sections :

(1) **West of the escarpment.**—This portion is bounded by the Rusape—Inyanga and the Rusape—Umtali roads, having the beforementioned outlier of muPfuti pushing in near Odzi from the south along the Tsungwesi river bed. Its eastern boundary is difficult to define and may be taken in general as the line of *Acacia rehmanniana*, which forms a narrow belt irregularly from Inyanga to Umtali along the west of the escarpment. There are three meteorological stations within this zone of which records are available ; Inyanga at the upper limit of

the zone ; Rusape at an average altitude and Umtali at the lower limit. The Umtali station occurs where the escarpment is not sufficiently high to produce a division of the muTsatsa zone into two by the interpolation of a mountain zone.

(2) **East of the escarpment.**—This is much more clearly marked, extending from the muPfuti zone below to about 5,000 ft., where the muTsatsa and the muJanje become dwarfed and very rarely manage to fruit (Plate 18. *a*). Here there is no meteorological station and none exists in a properly comparable site.

Biotic factors.—Man.—Apart from European farmers, mainly centered round the roads, the human population is chiefly centered round the kraal of the chief Umtasa and elsewhere in native reserves. Both make use of fire for " early grazing " and there is much evidence of severe overstocking and veld deterioration in this zone particularly between the Honde and Inyanga. Evidence of a fairly extensive human occupation in prehistoric times is to be found in the van Niekerk ruins at Inyanga. This may be the same culture responsible for the terraces and " slave pits " of the mountain zone and at any rate the result and effect of their occupation has been the same in both cases ; namely deforestation.

Succession and chief communities.—The writer did not make a very detailed examination of this zone. As in the case of the muPfuti, much further work is still required. The majority of the observations here made refer to the valleys of the Odzani, Honde and Numkwarara Rivers and to the Penhalonga Valley.

The climax.—The climax of this zone is subtropical evergreen high forest. While the rainfall to the east of the escarpment can safely be put at 40 ins. and over, at Rusape in the west it only exceeds 30 ins., in very favourable seasons. And, even if the ameliorating effect of a high forest vegetation on the escarpment and to the east of Rusape be admitted, insufficient data are anywhere available as to the possible extent of that amelioration. Consequently, while from field observations it appears that the climax of this zone round the escarpment is high forest of the subtropical type, such as exists at the Nyumterese Falls, Garuso in Portugese East Africa and Mt. Selinda (Plate 18. *b*) in Gazaland, it is as yet uncertain how far this forest could extend to the west ; whether, indeed, in terms of the climax at any rate, the muTsatsa zone is not really an unnatural one based on the present existence of a sub-climax vegetation with a very much wider range of tolerance than the climax stage. A community was noted in a kloof caused by erosion (Plate 19. *a*), ten miles west of the escarpment in typical muTsatsa, composed of shrubs typical of the ecotone of this high forest and, from the general presence of the indicator shrub *Hypercium quartinianum* it can be safely asserted

that the climax zone is at least some miles from the escarpment to the west.

The forest shows a well-marked structure of the usual type :—

(*a*) The dominant trees, with Lianes, canopy at an average height of 120-200 ft. (Plate 19. *b*), *Khaya nyassica* (Plate 20. *a*), *Schefflerodendron gazense*, *Lovoa Swynnertoni*, *Trichilia chirindensis*, and a parasitic fig (Plate 20. *b*), here and there are the chief constituent species.

(*b*) A second shrub storey of shade enduring shrubs. Many members of the Rubiaceae, e.g., *Tarenna*, *Grumilea*, *Empogona* and *Tricalysia*, are the chief members.

(*c*) The forest carpet, consisting chiefly of mosses and ferns with annual and perennial shade enduring herbs.

(*d*) A forest edge community with trees of different species and somewhat smaller stature such as *Gardenia*, *Croton*, *Polyscias* and even *Brachystegias*. A characteristic shrub and forb flora is also present in this edge community.

Insufficient data are available to note the lociation and faciation of this forest type.

Seral communities.

Secondary succession.—Secondary succession occurs, generally speaking, on the flatter portions, which have presented now and in the past an easier task to the cultivating native. Two distinct types are noticeable according to the type of rock from which the soil is derived, namely from granites or from schists. These two types, however, only become really distinct in the first tree stages preceding climax development.

The pioneer community.—The plants growing on denuded sites in this zone were not well noted. The following were seen, however. *Oldenlandia herbacea*, *Walafrida tenuifolia*, *Thunbergia lancifolia*, *Eragrostis*, *Pogonarthria* and *Cynodon dactylon*.

The early plants of the disturbed veld.—Where the veld has been distrubed a very characteristic flora of geophytes appears, whether the disturbance is due to firing or overgrazing or both. Among these the following are noteworthy. *Sida*, *Hermannia compressa*, *Triumfetta*, *Eriosema*, *Rhynchosia minima*, *Veronia Kraussii*, *Wahlenbergia denudata*, *Margaretta Whytei*, *Trichodesma physaloides*, *Astrochlaena malvacea* (Plate 21. *a*), *Ipomaea*, *Solanum panduraeforme*, and *Becium*.

The tall grass community.

(*a*) Undisturbed sites. The tall grass community on undisturbed sites contains *Trichopteryx*, *Tristachya* and *Panicum*, *Diplachne biflora*, etc., strongly reminiscent of the high-veld of the Transvaal (Plate 21. *b*, Glover, 1937 ; Weimarck, 1932).

(*b*) Disturbed sites. Disturbed sites are dominated by *Hyparrhenia hirta; Eragrostis, Pogonarthria* and *Hyparrhenia gazense* accompany it. A further prominent community here is one dominated by *Helichrysum Kraussii* (Plate 22. *b*).

(*c*) The accompanying forbs in both are chiefly those mentioned under par. ii, while the following shrubs invade : *Gymnosporia, Cissus, Rhus dentata, Clerodendron, Lippia salvifolia, Asparagus,* etc.

The first tree stage.

(*a*) **The muTsatsa community.**—The muTsatsa (*Brachystegia Randii,* Plate 23. *a*), is the dominant tree of this community. Here again, as with the muPfuti, the tree is a fire-resistant xerosere tree, invading following fire. Owing to this last it occupies a very much larger area within its proper zone than the muPfuti in Manicaland. The muTsatsa is commonly accompanied by the muTondo (*Berlinia globiflora*) together with *Hypericum quartinianum, Psorosperum febrifugum, Grewia occidentalis, Ochna, Dodonaea viscosa, Bersama, Lannea Schimperi, Tephrosia nyassae, Combretum holosericeum, Cussonia Kirkii, Pavetta rhodesiaca, Vangueria, Gardenia, Chrysophyllum argyrophyllum, Euclea divinorum, Carissa edulis, Solanum chrysotrichum, Vitex Hildebrandtii, Faurea speciosa, Ximenia americana, Phyllanthus discoideus,* and numerous forbs, sedges and grasses.

Pterocarpus Bussei was observed invading this community.

(*b*) **The muJanje.**—The muJanje (*Uapaca Kirkiana*) is here again present marking the disturbed site and seral to muTsatsa. The muTongoro has not been observed west of the escarpment. The muJanje is slower growing and smaller in this zone than in muPfuti.

(*c*) **The muOnga community I.**—The muOnga (see also under muPfuti) community (Plate 23. *b*), occupies schistose and alluvial soils and is, of course, particularly prominent round Penhalonga. Common shrubs accompanying this community are : *Anona senegalensis, Dichrostachys glomerata, Elephantorrhiza suffruticosa, Bauhinia fossoglensis, B. Petersi, Combretum apiculatum, C. erythrophyllum, C. Guenzii, Royena pallens, Gardenia asperula, Carissa edulis var. tomentosa, Cryptolepis oblongifolia, Phyllanthus guinensis,* and numerous forbs and grasses. *Dalbergia melanoxylon* was observed invaing this community.

(*d*) **The muOnga II.**—This muOnga (*Acacia Rehmanniana,* Plate 24. *a*), forms a community with a peculiar distribution being found at the zone of interaction between the muTsatsa and the mountain zones. Notable groups are to be found at Nodzi and on the road between Inyanga and Rusape. This community is mainly confined to rocky koppies and slopes. The accompanying shrub and forb flora is the same as in muTsatsa.

The Xerosere.—The Xerosere is a prominent feature of this zone (Plate 24. *b*), which is rich in residual soils and rocky slopes and boulders. The muTsatsa, accompanied by *Ficus* on the more inaccessible spots, is manifestly the final community of this sere, below the climax invasions. The physiognomic differences between the schist and granite sites in this sere need further investigation. The following were noted as prominent in this sere : *Cheilanthes hirta, Pellaea calomelanos, Cleome monophylla, Crassula Clunliffii, Borreria dibrachiata, Oldenlandia herbacea, Vangueria, Vernonia Steetziana, Wahlenbergia, Philippia, Myrsine africana, Barleria, Pouzolzia hypoleuca, Aloe, Asparagus, Bulbostylis, Aristida, Hyparrhenia.*

The Hydrosere.—The usual stages are here observable, culminating in the *Syzygium* community (*S. cordatum* and *S. guineense*). In the climax community *Adina microcephala* would characterise this locies just as in the muPfuti zone. The following shrubs and herbs were noted as characteristic of this sere : Shrubs : *Sesbania, Mikania natalensis, Rhamnus prinoides, Trema guineense, Rubus, Jasminum, Salix safsaf, Phoenix reclinata, Cleistachne sorghoides, Hyparrhenia cymbaria, Miscanthidium teretifolium, Panicum maximum, Pennisetum,* etc. Herbs : *Nasturtium officinale, Polygala, Hypericum Lalandii, Alchemilla, Apium leptophyllum, Helichrysum fulgidum, Samolus Valerandi, Limosella aquatica, Utricularia, Crinum regale, Commelina, Ascolepis capensis, Andropogon eucomus, A. laxatus, Brachiaria, Sacciolepis.*

(D) The mountain zone.—This zone includes all land above 5,000 ft., and in this zone are the peaks of S. Rhodesia, Mt. Inyangani, 9,000 ft., and Mt. Nuza, 6,666 ft., separated by the Honde and Pungwe gorges. There is a plateau area associated with each ; the Inyanga Downs in the north of the gorges and the Mt. Nuza plateau to the south. The climate on the whole is that of mountain forest, perhaps best defined as those parts subject to " vumbi " or mist equivalent to the mist belt of the Union (Bews, 1920). The area grades off into muTsatsa to the north and east while still fairly high, i.e., in excess of 5,000 ft. There are two meteorological stations in the zone; (*a*) At Mt. Nuza ; and (*b*) At Stapleford (5,200 ft.). The readings for the Stapleford station have long been considered atypical by the Meteorological Office in Salisbury, and indeed the station is situated in a frost hollow on the banks of the Odanzi on the south-west face of Mt. Nuza. They are, however, useful indications of the degree of variation within the mountain zone.

Biotic factors.—Man.—Evidences of a prehistoric culture in this region are many and impressive, consisting of so-called slave pits (Plate 25) with their adjoining terraces and aqueducts. Mason, (1933), has examined this culture and has identified the pottery remains with those

of the van Niekerk ruins in the muTsatsa zone at Inyanga. Many of the slave pits have been invaded by trees, but as yet investigations on the tree rings with a view to determining the age of the invading vegetation have not yet been attempted. To Mason's statement : " for many of the plants connected with these ruins are not indigenous " exception is taken. Such is not the case.

Present-day man, in the shape of the Manyika tribe, carry on here mainly a pastoral agriculture ; their crop culture being limited to vleis and special small sites (Plate 26. *a*). A much higher standard of building and cleanliness in this climatic zone compared with the previous two is noteworthy.

Animals.—Animals play as important a part in the development of the vegetation here as elsewhere. An instance will be cited in discussing the secondary succession. **Locusts** in periodic swarms are frequent and do much damage to the vegetation by defoliation. Here, however, as elsewhere, our knowledge of the animal ecology is sadly deficient.

The climax.—The climax of this zone is evergreen mountain forest with a considerable faciation and lociation as follows. (Note: faciation = community induced by a micro-differentiation within the climate ; lociation = community induced by an edaphic difference.)

(*a*) **Hydroseral climax lociation.**—The maPande (*Widdringtonia Whytei*) (Plate 26. *b*), together with *Podocarpus milanjianus* may form the ultimate vegetation here. They exist at present only as relict groups of small number, particularly with a cool south and south-east aspect. (This may be a climatic relict in the sense of Clements, 1934.) *Curtisia faginea, Ilex mitis, Macaranga mellifera, Syzygium cordatum, Aphloia myrtifiora* and *Cussonia umbellifera* form this community (Plate 27. *a*), the last, perhaps, because of its greater potential height, being the most important in the warmer sites. Shrubby and herbaceous plants of this lociation are : *Marattia fraxinea, Cyathea Deckenii, Impatiens sylvicola, Hydrocolyle Mannii, Galopina circeaeoides, Lobelia Stricklandae* (Plate 27. *b*), *Plectranthus, Strelitzia, Cyperus, Ehrharta erecta, Oplismenus africanus* and *Melinis*.

(*b*) **The xeroseral climax lociation.**—The xerosere is ultimately occupied by a *Philippia-Protea* scrub with occasional invasions on pockets of deep soil of *Rapanea melanophleos*. The summit of Mt. Inyangani is a good example (Plate 28. *a*). The constituents are : *Philippia benguellensis, Protea melliodora, Protea sp., Erica Johnstoniana, Myrsine africana* and *Aloe arborescens* ; accompanied by *Anemone peneensis*, (Plate 28. *b*), *Lotononis humifusa, Crassula arborella, C. abyssinica, C. nodulosa, Drosera, Alepidea propinqua, Erica, Hebenstreitia dentata*,

Eragrostis grandis, Festuca costata, Koeleria, Monocymbium, Pentaschistis' Trichopteryx, Tristachya hispida and *Trachypogon plumosus.*

(*c*) **The climax proper.**—On the hot northern and north western aspects the muJerenje is dominant (*Albizzia fastigiata*) with more and more of the m'Tengembia (*Polyscias*) (Plate 29. *b*). This latter tree seems to be invading from the north and bids fair to overtop the muJerenje than which it is a quicker growing taller tree. Ficus with the parasitic habit is frequent here on muJerenje and others. The forest shows the normal terracing, having a canopy (Plate 29. *a*), shrub storey and forest carpet. A good example is the forest of Ziwani on the Imbesa Forest estate. The shrub storey contains: *Grumilea, Psychotria, Pavetta, Tarenna, Piper capense, Fleuria, Peristrophe,* etc. The lianes of the canopy and forest edge are: *Mikania natalensis, Senecio, Solanum, Ipomaea involucrata, Aristolochia, Thunbergia alata, Momordica Mokorra, Rumex sagittatus.* In the forest carpet community (Plate 30. *a*), the following were noted: (This also includes a large number of epiphytes which are, logically, to be included in this community in this zone, the frequent mists rendering them scarcely to be considered xerophytic, marked *) *Aerobryum capense*, Mastigobryum adnexum*, Pilotrichella chrysoneura*, Plagiochila crispulo-caudata*, Porothamnium natalense*, Asplenium hypomelas*, A. linearilobum*, A. Mannii*, A. pergracile, A. Saundersonii*, Blechnum capense*, B. tabulare, Dryopteris africana, Elaphoglossum Aubertinii*, E. isabelense*, Hymenophyllum Kuhnii*, Loxogramme lanceolata*, Lycopodium verticillatum*, L. ophioglossoides*, Selaginella abyssinica, S. Kraussiana, Vittaria*, Thalictrum rhynchocarpum, Streptocarpus*, Peperomia reflexa*, Viola abyssinica, Adenostemma Dregei, Plectranthus laxiflorus, Tritonia laxifolia,* and the grasses noted under *a*.) The forest edge species, being of importance in the seral progress, are discussed later.

Primary succession.—Primary succession is now only observable in the hydroseral and xeroseral communities in any long series of stages. Elsewhere it only appears in the reproductive phases in the climax.

Secondary succession.—Secondary succession stages occupy a very large area since the region has undoubtedly been subject to the rule of axe and fire and other instruments of primitive agriculture, together destroying the pre-existing climax.

(*a*) **Stages noted resulting from disturbance** (e.g., ploughing, hoeing, overgrazing).

The pre-Cynodon stage.—This stage normally is of short duration, being composed of annuals and ephemerals, giving place in the course of a single season to the next stage. Here, however, especially on sites which

are all too common, exposing rotting rock in lieu of soil, may persist for many years. Commonly growing here were : *Erigeron canadense, Lobelia rosulata, Panicum laevifolium, Eragrostis, Sporobolus*, etc.

The Cynodon stage.—This stage is here remarkable for the small amount of Cynodon present, and is indeed chiefly named such in conformity with experience elsewhere (Glover, 1937). *Eragrostis* and *Panicum* are the dominants accompanied by geophytes noted below.

The tall grass stage.—This stage intervenes between the Cynodon stage and the first shrub stage where acceleration influences are at work. Otherwise the *Cynodon* stage merges into the *Trichopteryx* community noted below. It consists of *Hyparrhenia* and *Cymbopogon*, together with several tall perennial forbs, e.g., *Helichrysum spp.*

The shrub-tree forest stages follow as described below.

(*b*) **Stages observable through the persistent use of fire.**

The Trichopteryx community.—Following the use of axe and fire the mountain forest gives way to a community composed of *Trichopteryx* and its associates. The extent of this area is well shown on Henkel's map and its overlap with the muTsatsa is already noted. This overlap is probably due to tree felling for agricultural and hut-building purposes, coupled with the greater range of environmental tolerance of the *Trichopteryx* community. The grasses of this community are : *Alloteropsis semialata, Andropogon schirensis, Brachiaria serrata, Chloridion Cameronii Digitaria, Eragrostis, Hyparrhenia, Monocymbium, Panicum natalense, P. spp. Rhynchelytrum setifolium, R. roseum, Themeda triandra, Trachypogon plumosus* and *Trichopteryx simplex* (cf. Glover, 1937).

Associated geophytes and perennial plants.—There are also often found with the previous three grass stages the following geophytes and perennial plants. *Pelargonium aconitophyllum, Hypericum peplidifolium, Oxalis semiloba, Dolichos Buchanani* (Plate 30. *b*), *Eriosema Burkei, E. cordatum, E. montana, Indigofera Rehmanni, Lotononis Eylesii, L. corymbosa, Rhynchosia monophylla var. Eylesii, R. totta, Vigna, Peucedanum Clausenii, Pentanisia variabilis, Oldenlandia, Helichrysum adenocarpum, H. nudifolium, Senecio bupleuroides, Vernonia Bainesii, V. monocephala* (Plate 31. *a*), *Wahlenbergia denudata Asclepias, Schizoglossum, Xysmalobium, Ipomaea crassipes, Cycnium adonense, Harveya Randii, Justicia, Becium obovatum, Leucas milanjiana, Cluytia monticola, Euphorbia cyparissoides, Euphorbia depauperata*, many *Orchids, Gladiolus, Morea, Hypoxis filiformis, H. villosa, Bulbine, Chlorophytum, Dipcadi, Drimia pallens, Ornithogalum, Scilla transvaalensis, S. ovatifolia, Tulbaghia, Albuca, Cyanotis nodiflora*, etc.

Seral stages to the mountain forest climax.

Hydroseral.—Two main stages are noticeable, clear cut in their extremes but of course merging in intermediate places.

(*a*) **Quick running mountain streams.**—These from their very nature are protected from fire, having steep sides, and the rate of succession is fast. Sedges are relatively uncommon and the riverine grasses form the first stages. The first community consists of : *Crassula alsinoides, Juncus, Digitaria, Haemarthria altissima, Leersia hexandra* and *Setaria orthostica.* The riverine grass community becomes taller through the invasion of further species and certain shrubby composites namely : *Helichrysum odoratissimum* and *H. umbraculigerum*, which give character to this community. Prominent grasses are : *Digitaria, Ischaemum arcuatum, Imperata cylindrica, Eulalia villosa, Schizachyrium brevifolium* and *Setaria splendida.* This stage culminates in the entry of *Cyathea Dregei.* Further shrubs very soon invade this stage, the most prominent being : *Hypericum leucoptychodes, Rubus* and *Maesa lanceolata.* Other shrubs noted here were : *Clematopsis, Polygala speciosa, Pavonia Meyeri, Rhamnus prinoides, Rhoicissus cuneifolius, Psoralea foliosa, Smithia thymodora, Cliffortia sp., Choristylis shirensis, Dissotis princeps, Heteromorpha arborescens, Anthosperum, Philippia benguellensis, Buddleia salvifolia, Lycium, Sutera grandiflora, Clerodendron sansibarense, Lippia asperifolia, Moschosma riparia, Leonotis, Pycnostachys, Cluytia, Aloe* and *Smilax kraussiana.* Subsequent to the invasion of these shrubs the following trees appear and the vegetation gradually develops into the hydroseral lociation of the climax. *Aphloia myrtiflora, Pittosporum, Toddalia aculeata, Ilex mitis, Syzygium cordatum, Cussonia umbellifera, C. spicata, Curtisia faginea, Rapanea melanophleos, Carissa arduina, Lachnopylis sambesina, Halleria lucida, Macaranga mellifera* and *Myrica pilulifera.*

(*b*) **The vlei and streambeds of low gradient** (Plate 31. *b*).—Here natural topographical fire-protection is absent, frost is common (most of the vleis are natural frost-hollows) and the succession is thus held in check. Stages beyond the meadow stage are uncommon. Sedges are prominent together with riverine grasses of relatively short stature in at least two well-marked zones.

Inner zone.—The inner zone is dominated usually by *Scirpus macer* and contains *Potomageton nodosus, Brachiaria, Haemarthria altissima, Stiburus alopecuroides, Utricularias* and many *Orchids.*

Outer zone.—The outer zone is more of a mixture and often contains small socies of inner zone species in process of displacement. Prominent here are *Cyperus, Juncus, Andropogon eucomis, A. huillensis, Arundinella Ecklonii, Eriochrysis pallida, Imperata cylindrica, Ischaemum arcuatum,*

Schizachyrium brevifolium, *Setaria splendida*, *Sporobolus*, with socies of *Eragrostis grandis* and *Phragmites vulgaris* round the edge. On the banks of running water through these vleis is a very characteristic community of Ainya (*Cliffortia*) and *Leucosidea sericea* in separate socies.

Forbs.—Common forbs associated with all these communities, though most frequent in the outer zone, are : *Lycopodium sarcocaulon*, *Polygala*, *Geranium incanum*, *Impatiens trichochila*, *Argyrolobium*, *Agrimonia eupatorium*, *Alchemilla inyangensis*, *Drosera madagascariensis*, *Epilobium nereiphyllum*, *Hydrocotyle sibthorpiodes*, *Cephalaria*, *Scabiosa*, *Denekia capensis*, *Gerbera*, *Widelia abyssinica*, *Xysmalobium*, *Chironia Krebsii*, *Swertia stellarioides*, *Sopubia*, *Striga elegans*, *Gladiolus* and *Zantedeschia aethiopica*.

Cyathea Dregei invades the outer edge of the vlei and is accompanied by *Hypericum leucoptychodes* and *Rubus* and eventually, though much more slowly, the climax lociation is established (Plate 32. *a*).

Xeroseral.—This sere is well defined here and has, particularly round the summit of Mt. Inyangani, been held in check as much by the absence of forest in its immediate vicinity to provide disseminules as by any active agent. Succulents are common here in the early stages, e.g., *Crassula* and *Aeolanthus*, and these are followed by the Trichopteryx grassland in modified form. *Protea-Philippia* scrub forms the climax lociation as already noted.

Secondary succession.—The balance of the evidence available, in the opinion of the writer, indicates that a pre-existing forest climax has here been destroyed and the resultant sub-climax grassland held in check by the annual use of fire.

This statement receives considerable support from the stages observed at Stapleford Forest Reserve since that area was declared a reserve and carefully protected from fire (see similar observations by Henkel, 1916, on the Drakensberg). These stages are particularly noticeable on the northern patrol and were carefully noted by the writer. This plateau consists mainly of the plateau associated with Mt. Nuza and stretching north from it for a distance of two to three miles to the Honde escarpment. It forms part of the *Trichopteryx* grassland (cf. Plate 32. *b*), except that subsequent to the fire protection a large number of clumps of woody vegetation have developed. These clumps are termed " churu " by the natives (Plate 33. *a*). From an analysis of these churu and from the fact that the larger ones are to be found next to the eastern escarpment, the smaller ones distant from it, it is clear that they represent invasions of the grassland by woody types of vegetation. The stages of the re-invasion may be summed up as follows :—

(1) *Hypericum leucoptychodes* (Plate 33. *b*).—*Bramble* community.

(2) A community dominated by *Maesa* and *Rapanea* (Plate 34. *a*) with the preceding forming an edge community or ecotone.

(3) A short forest community with stages 2 and 1 round the edge in that order.

The coaction of animals in this process is fairly clear. The sites of these churu are almost invariably areas previously disturbed by animals of some sort. And on establishment they become the headquarters of rodent communities and wild pig. Duiker too use them as "homes" particularly during the heat of the day. The probable sequence of events in most cases is as follows :—

(1) The establishment of a termitary in pre-protection days in the grasslands.

(2) An attack on the termitary by an ant-bear. Before or after fire-protection.

(3) The invasion of the ant-bear hole by a tall growing, shade producing herb or fern (e.g., *Mohria caffrorum*). (See also Bews, 1913.)

(4) The invasion of this tiny community by a seedling *Bramble* or *Hypericum* giving rise soon to the early stages noted.

The first forest stage which follows the increase in size of the churu is perhaps best exemplified by the forest of chiNyamariro (Plates 34. *b* 35). *Syzygium* (the muOtoto) and *Conopharyngia* (the muChechene) are the dominants while a *Podocarpus milanjianus* some thirty feet in height is present.

Other evidence.—Mr. E. E. Phaup has drawn attention to the following peculiar feature of the Odanzi Valley. The river rises on the south-west face of Mt. Nuza, and flows west through a twisting, flattish streambed till reaching the muTsatsa zone, when the character of the stream alters entirely. It now becomes a steep-sided stream, which, in the rains, is a rushing torrent. This feature is common to all the west flowing streams in the mountain zone. Together with the existence of relics of a forest vegetation all along the immediate eastern face of the escarpment, in kloofs and on small plateau, and the evidence as to the speedy invasion of the grassland by forest vegetation following fire protection, this leads to the conclusion that a forest vegetation existed here prior to the development of fire and axe as potent factors of the environment. In fact this is not a mountain grassland, but a mountain forest zone.

Conclusions.

(1) Stone-age man probably had little effect on the vegetation of Manicaland, since though probably acquainted with the use of fire, he was not a hut-building, cattle-owning type and probably ate his food raw.

(2) Iron-age man, probably Bantu, owning and grazing cattle, building dwellings and cooking food, and using axe and fire to further these occupations as well as hoe to cultivate crops, has been in occupation of Manicaland probably not less than one thousand years.

(3) The present vegetation of all three zones noted by Henkel, most likely as a result of (2), is characterised by sub-climax vegetation of muPfuti (*Brachystegia*), muTsatsa (*Brachystegia*) and mountain grassland (*Trichopteryx* community).

(4) Relics of an evergreen forest climax of three main types are to be found in each however :—

(*a*) **In muPfuti,** in the riverine vegetation particularly of the Honde-Pungwe confluence (seen), and probably also the forest of the Amatongas in Portuguese East Africa. Tropical evergreen forest.

(*b*) **In muTsatsa,** in the forests of the Numterese Falls in the Honde Valley, of Mt. Selinda in Gazaland, and of Garuso in Portuguese Manicaland. Sub-tropical evergreen forest.

(*c*) **In the mountain zone,** in the forests of the kloofs and eastern sides of the mountain range such as at Ziwani and chiNyamariro. Temperate evergreen forest.

(5) While the above conclusions hold for most of the actual eastern escarpment with its high rainfall, some considerable dubiety exists concerning the western extension of the area round Rusape. Here the rainfall falls off and experiment with exclosures is prerequisite to the final answer.

Discussion.

The concept of the climax arose tentatively many years ago (Clements, 1904), but was first clearly enunciated in 1916 (Clements, 1916). Since then the concept has developed and certain difficulties have arisen, Phillips (1934-35), has cleared the air and defined the position of the " mono-climax " school, others (see Phillips, l.c. refs.) have proposed a " poly-climax " view, while Braun (1935) has endeavoured to reconcile the two with her term association-segregate.

The differences seem to have arisen from the fact that the climaxes described initially in North America exhibit a considerable species-uniformity, which has thereafter been inherently implied in the writings of many authors. But, that that is not the case, is apparent not only from the later writings of Clements and from Phillips (1931), but also from phenomena noted by Allee (1931) in Panama and commented upon by Adamson (1931) for Table Mountain. The latter re-emphasised the concept of " life-form dominance " rather than species dominance as a guide to the recognition of a climax. In other words the emphasis is thrown not on the qualitative composition but on the structure of vegetation.

Further differences have arisen from the fact that different species groups may hold different soil types within one climax, and, the emphasis being inherently laid on species-uniformity, these have been called "edaphic climaxes."

That any of these differences are greater than the difference normally to be noted in the hydroseral location of a climax would be an overstatement and yet to term such a separate "climax" is manifestly inadvisable. Further, a moment's reflection will show that, at any rate in cases such as that of the mountain zone reported here, such a hydroseral location is inherent in the drainage system of an escarpment which itself causes the climate. In other words when ultimately the escarpment be eroded flat enough to render the hydroseral location unimportant, the height of the whole escarpment itself will be so changed as to radically alter the climate.

Hence it is concluded that a species diversity is inherent in a climax and that cases of species-uniformity are to be interpreted as special cases. That, in fact, a concept of the climax embracing species-diversity due to edaphic causes (location) is as just as one which embraces species-diversity due to micro-climatic differences (aspection, faciation).

This is the concept of the climax used in this paper.

Clements' latest ideas (1934-36) view climaxes themselves in relation to a climatic category bearing the same relation to the climax climate as genus does to species. This is the panclimax and is itself derived genetically from an eoclimax. Manifestly we have here in Manicaland a panclimax of this sort (evergreen high forest) which is differentiated into three climaxes. The necessity for such a concept is apparent when one considers the difficulty of drawing a definite limit to the three climaxes discussed. They are in fact most easily defined in terms of the present predominant fire sub-climaxes. The further concepts of pre- and post-climaxes may be introducing difficulties. At any rate as far as the present study is concerned it would be exceedingly difficult to distinguish at times between a location and a pre- or post-climax. Thus the Gymnosperms, *Widdringtonia* and *Podocarpus*, although apparently forming a hydroseral location of the mountain forest may equally be a pre-climax relict from a colder climate.

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PLATE 12. (a) Tall grass stage (*Hyparrhenia cymbaria*) of secondary succession in muPfuti zone.
(b) Typical muJanje community in muPfuti zone.

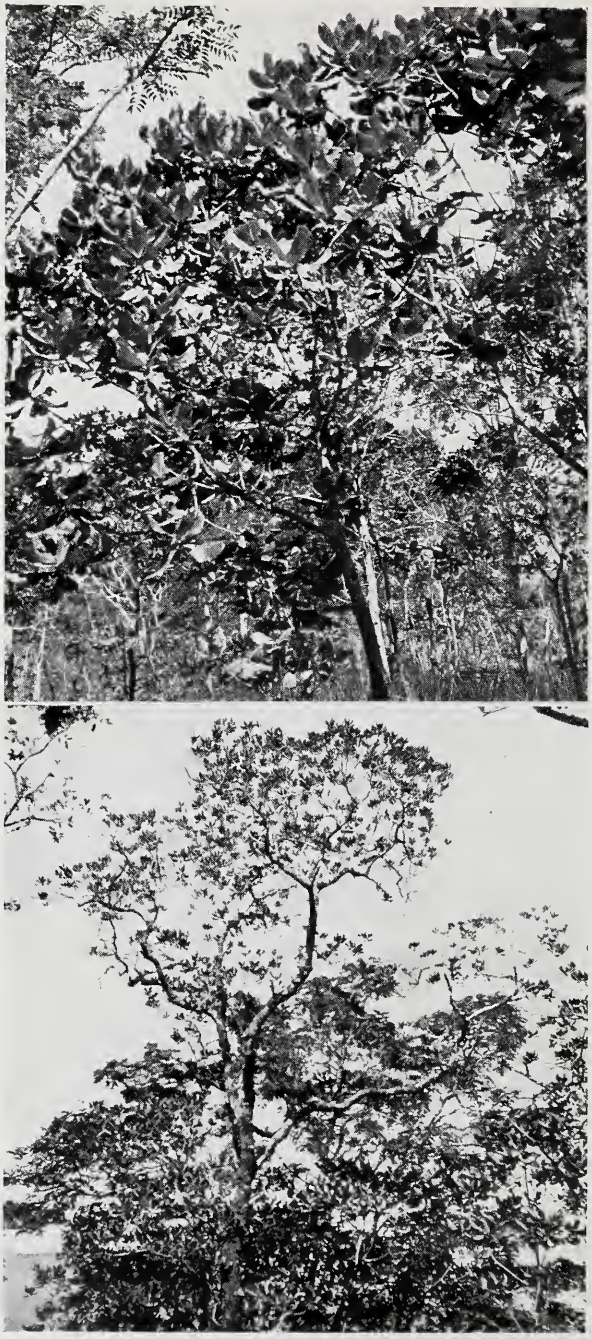

PLATE 13 (a) *Uapaca Kirkiana*, the muJanje, in the muPfuti zone.
(b) *Uapaca nitida*, the muTongoro, in the muPfuti zone.

PLATE 14. (a) Field made by cutting and burning muJanje. Coppice of muJanje in foreground.
(b) Seedling muJanje invading *Hyparrhenia*. 8-10 year old trees behind.

PLATE 15. (a) Characteristic *Podostom* from the hydrosere in the muPfuti zone
(b) Solitary muChakati (*Parinarium*) surviving in the overtrampled environs of the dip-tank, Honde Valley.

PLATE 16. (a) Tall *Hyparrhenia* in secondary succession stage of hydrosere in muPfuti zone.
(b) In foreground lithosere with *Aloe*. Behind typical Narwatsi community.

PLATE 17. (a) muPfuti (*Brachystegia flagristipulata*), Honde Valley.
(b) Narwatsi (*Brachystegia utilis*), Numkwarara Valley.

PLATE 18. (a) Upper limit of muTsatsa zone. Honde Valley escarpment. Dwarf muJanje and muTsatsa in middle foreground.
(b) Climax of subtropical evergreen high forest of muTsatsa zone. Mt. Selinda Forest, Gazaland.

PLATE 19. (a) Kloof caused by erosion, 10 miles west of escarpment, containing *Rubus, Maesa, Myrica, Helichrysum, Stoebe*; typical ecotone plants of subtropical evergreen high forest.
(b) Canopy of the climax forest. Nyumterese Falls, Honde Valley.

PLATE 20.

(a) *Khaya nyassica* in Garuso Forest, Portuguese Manicaland. (b) Typical "parasitic Fig" from Mt. Selinda Forest.

PLATE 21. (a) *Astrochlaena malvacea*, typical geophyte of disturbed veld in muTsatsa zone. From nuOnga community, Penhalonga.
(b) *Trichopteryx* grassland of muTsatsa zone.

PLATE 22. (a) Community of *Hyparrhenia hirta* in secondary succession in muTsatsa near Inyanga.
(b) *Helichrysum Kraussi* community in secondary succession near Inyanga.

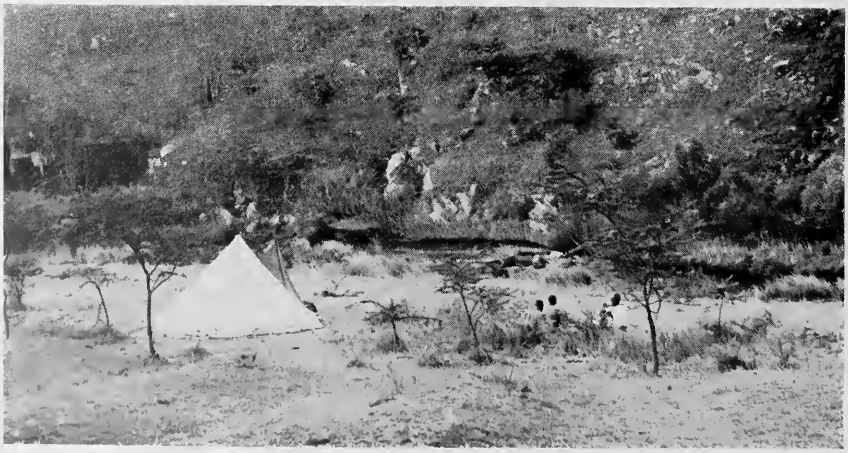

PLATE 23. (a) muTsatsa (*Brachystegia Randii*) community ten miles east of Rusape.
(b) muOnga I community (*Acacia litakunensis*). Odzani River valley.

PLATE 24. (a) muOnga II community (*Acacia Rehmanniana*), Inyanga-Rusape road.
(b) Typical lithosere with *Aloe* in muTsatsa zone.

PLATE 25. (a) "Slave pit" on Mt. Nuza showing invading vegetation (*Rapanea melanophleos*, *Cussonia spicata*).
(b) Cleared "pit" showing entrance and some of the accumulated debris.

PLATE 26. (a) Small pumpk n and gourd garden on streambanks on western edge of mountain zone.
(b) *Widdringtonia milanjiana* (maPande) in streamside vegetation on Inyanga Downs.

PLATE 27. (a) Canopy of streamside forest in Nyumkombe Valley containing *Cussonia umbellifera*.
(b) *Lobelia Strieklandae* on banks of stream emerging from Ziwani Forest at lower limit of mountain zone.

PLATE 28. (a) Xeroseral climax locies on summit of Mt. Inyangani. *Philippia-Protea* scrub.
(b) *Anemone peneensis* from summit of Mt. Nuza.

PLATE 29. (a) Canopy of evergreen mountain forest (temperate): Ziwani Forest; Imbesa Estate.
(b) *Polyscias*, the m'Tengembia from kloof forest on the north eastern slopes of Mt. Nuza.

PLATE 30. (a) *Oplismenus africanus* in forest carpet of Ziwani Forest.
(b) *Dolichos Buchanani*, typical geophyte of mountain grassland.

PLATE 31. (a) *Vernonia monocephala*, another mountain grassland geophyte. (b) Hydroseral community of slow running streambed of Mt. Nuza plateau. The Anya (*Cliffortia*) community along the water channel can be clearly distinguished.

PLATE 32. (a) *Cyathea Dregei* accompanied by *Hypericum leucoptychodes* forming the outer zone of the Hydroseral community.
(b) The mountain grassland (*Trichopteryx community*) at Inyanga Downs.

PLATE 33. (a) Invasion of mountain grassland by churu, Mt. Nuza plateau looking over towards Mt. Roonje.
(b) *Hypericum leucoptychodes*, flowering branch.

PLATE 34. (a) Fairly old churu cleared of all but central group of *Rapanea melanophloeos*.

(b) chiNyamariro forest from Mt. Rupere. The forest caps the cliff in the middle distance and the topographical fire protection (the prevailing wind is easterly, i.e., from the left of the photograph) is well seen.

PLATE 35. (a) chiNyamariro forest from the west.
(b) chiNyamariro forest ; closer view, showing the ecotone :—*Aphloia- Hypericum, Philippia-Helichrysum, Eragrostis.*

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VOL. IV.

A NEW ALOE FROM NATAL.

(With Plate 36.)

By G. W. Reynolds.

In the present paper a new *Aloe* is described from the hilly midlands of Natal.

Aloe dominella Reynolds. Species nova, *A. Woollianae* Pole Evans affinis, sed floribus parvis luteis 18 mm. longis facile distinguitur. *Planta* succulenta, usque ad 50 caulibus. *Folia* circiter 20, multifaria, anguste linearia, erecto-patentia, circiter 35 cm. longa, 10 mm. lata, supra planiuscula, subtus convexa, ad margines e basi denticulis crebris cartilagineis ciliata. *Inflorescentia* simplex, capitata, 35 cm. lata. *Racemus* dense capitatus, circiter 4 cm. longus, 8 cm. diam., circiter 20 floribus. *Bracteae* usque ad 15 mm. longae, 3 mm. latae, anguste ovato-acuminatae. *Pedicelli* usque ad 20 mm. longi. *Perigonium* luteum, cylindrico-trigonum, 18 mm. longum. *Segmenta* exteriora et interiora libera. *Filamenta* complanata. *Antherae* per 3—4 mm. exsertae. *Stigma* demum 7 mm. exserta. *Ovarium* 4 mm. longum, 2 mm. diam.

Hab. Natal. Hills between Estcourt and Mooi River ; cultivated plant fl. 10 Feb. 1938 in Johannesburg, Reynolds 2094! (type) in National Herbarium Pretoria. (Plate 36.)

This new *Aloe* is described from a plant which was collected by Mr. F. W. Reitz, Pretoria, and which flowered in my collection in Johannesburg in February 1938. Mr. Reitz collected plants in the hills about 14 miles south-east of Estcourt on the road to Mooi River, Natal ; plants were in fruit in March 1937, while one large specimen collected and subsequently grown by Mr. Reitz in Pretoria had over 50 tufted stems up to 15 cm. long.

Mr. J. F. de Wet, Vryheid, has also kindly sent plants to me which he collected on the farm "Northcote," about 14 miles south-east of Estcourt, alt. 4,000 ft. Mr. Basil Christian, "Ewanrigg," Arcturus, S. Rhodesia, has sent a plant to me from Elandslaagte (betwen Ladysmith and Dundee) while Mr. B. Nicholson, C.M.G., C.B.E., Mbabane, Swaziland, has also kindly donated plants from this locality, and writes concerning them "The plants sent came from Miss Quested's farm at Elandslaagte, on the hill near the station where the battle was fought; they have small yellow flowers in April." These plants appear to be conspecific but I have not seen flowers.

A. dominella closely resembles *A. Woolliana* Pole Evans in general habit of growth, tufted stems, size of rosettes and leaves, but differs in the size and colour of flowers and the flowering period. *A. Woolliana* usually flowers in August—September, and has red flowers up to 35—40 mm. long, whereas *A. dominella* flowers in February and bears small yellow flowers only 18 mm. long.

Other near allies are *A. chortolirioides* Berger and *A. Boastii* Letty. The former differs from *A. dominella* with smaller rosettes, narrower leaves, and red flowers averaging 30 mm. in length. It might be recorded here that Berger was mistaken in placing his *A. chortolirioides* under "Raceme lax and elongate" in his key to the Section *Leptoaloe,—vide* Das Pflanzenreich, Liliac.-Asphodel.-Aloin. (1908) p. 165. Along the Saddleback Range near Barberton (type locality) and in cultivation, I have never seen any plant with racemes other than capitate.

As regards *A. Boastii*, due to the kindness of Mr. B. Nicholson I was recently able to study plants of this species from near Forbes Reef, Swaziland (type locality), and to compare them with typical *A. chortolirioides* from the Saddleback, Barberton. The result of this investigation left no doubt in my mind that *A. Boastii* is only a yellow flowered form of *A. chortolirioides* meriting not more than varietal rank.

Another species to be considered, and one about which very little is known in South Africa, is *A. linearifolia* Berger. This species was described by Berger (in Engl. Jahrb. LVII, 640, 1922) with, *inter alia*, "leaves few, about 6, subdistichous, linear, not keeled, with narrow cartilaginous toothless margin . . . perianth yellow, 12—14 mm. long . . ." Berger cites "Fairfield, Moyeni, fl. 19 March 1912." The locality has remained in doubt until after much investigation Rev. F. J. Gerstner kindly informed me that the farms Fairfield and Moyeni adjoin each other, and are situated near Dumisa on the Umzinto—Ixopo narrow gauge line, South Natal.

I have not seen plants from this locality, consequently this species is known to me only from the published description. The 14 mm. long

FIG. 1. FIG. 2. FIG. 3.

Plate 36. *Aloe dominella*, Reynolds.

FIG. 1. Plant from hills between Estcourt and Mooi River, Natal, fl. 10 February, 1938 in the author's garden in Johannesburg. × $\frac{1}{7}$ approx.

FIG. 2. Raceme × $\frac{1}{3}$ approx.

FIG. 3. Flowers 1/1 from bud to post-pollination stage.

yellow flowers suggest a close relationship with *A. dominella*, but with " leaves about 6, sub-distichous . . . toothless cartilaginous margin " *A. linearifolia* certainly appears to differ considerably from the plant now described which has tufted stems, 20 leaves, multifarious and margins distinctly ciliate with $\frac{1}{2}$—1 mm. long firm white teeth.

Description ; Plant succulent with up to 50 stems in tufts, the stems up to 15 cm. long, covered with the dry remains of old leaf bases. *Leaves* about 20, multifarious, narrowly linear-attenuate, erectly spreading, about 35 cm. long, 10 mm. wide low down, the sheathing articulate part enlarging to about 25 mm. wide ; upper surface flat to sub-canaliculate, not spotted ; lower surface convex, with numerous small white spots near base ; both surfaces dull green ; margins with a very narrow cartilaginous white edge armed with firm white teeth $\frac{1}{2}$—1 mm. long, 2—5 mm. distant, usually larger near base smaller upwards. *Inflorescence* capitate, simple, about 35 cm. long. *Peduncle* flattened low down, brownish, clothed from about the middle upwards with several ovate-acuminate scarious brownish sterile bracts up to 20 mm. long, 10 mm. broad, about 5-nerved. *Raceme* capitate, about 4 cm. long, 8 cm. diam., about 20 flowered. *Bracts* lowest up to 15 mm. long, 3 mm. wide, narrowly ovate-acuminate, thin scarious brownish, 3—5 nerved. *Pedicels* green, lowest up to 20 mm. long. *Perianth* yellow, 18 mm. long, cylindric-trigonous slightly clavate, very shortly stipitate at base. *Outer segments* free to base, with 3 greenish nerves confluent at apex, the apices slightly spreading. *Inner segments* free to base (not cohering to the outer), broader than the outer, slightly carinate, the keel yellowish. *Filaments* flattened, the 3 inner narrower and lengthening in advance of the 3 outer, lemon yellow. *Anthers* the 3 inner and 3 outer in turn exserted 3—4 mm. *Stigma* at length exserted up to 7 mm. *Ovary* green, 4 mm. long, 2 mm. diam.

A NEW ALOE FROM SOUTH-WEST AFRICA.

(With Plate 37.)

By G. W. Reynolds.

Aloe Carowii Reynolds. Species nova in Sectione *Serrulatae*. Affinis *A. variegatae* L., sed foliis paucioribus parvisque differt. *Planta* succulenta, acaulescens, stolonifera. *Folia* plerumque 6, sub-trifaria, usque ad 7 cm. longa, 3—4 cm. lata ; supra concava, viridia, copiose albo-maculata ; subtus convexa, supra medium leviter carinata ; ad margines dentibus parvis albis 1 mm. longis, 2—5 mm. distantibus armata. *Inflorescentia* simplex vel 1—2 ramosa, usque ad 50 cm. alta. *Racemus* sublaxe cylindrico-acuminatus, circiter 30—40 floribus. *Bracteae* circiter 6 mm. longae, basi 4 mm. latae, anguste acuminatae, subscariosae 1-nervatae. *Pedicelli* 17 mm. longi. *Perigonium* 30 mm. longum, basi subglobosa-inflatum et 7 mm. diam., supra ovarium constrictum (5 mm.) hinc leviter decurvatum et fauces versus ampliatum. *Segmenta exteriora* per 7 mm. libera, apice nervis 3 viridibus notata ; interiora libera, marginibus pallidioribus. *Genitalia* vix vel brevissime exserta. *Ovarium* 6 mm. longum, 3 mm. diam.

Hab. Mandated Territory of S.W. Africa : Cultivated plant from quartz hills 30 miles East of Nauchas, fl. 7 Feb. 1938 in Johannesburg, Reynolds 2247! in National Herb. Pretoria. (Plate 37.)

This interesting novelty was first discovered about 4 years ago by Mr. R. Carow, and subsequently collected by Mr. W. Triebner, of Windhoek, in the Nauchas mountains about 30 miles east of Nauchas, under bushes on quartz hills. Mr. Triebner records that Nauchas is a farm and Police Post in Bastard Land, the Naukluft mountains being about 50 miles long and to the west, the Rehoboth mountains to the north, the Neuras mountains to the east, with the town of Rehoboth lying about 80 miles north-eastwards. Mr. Triebner has also collected this species in the Zaris mountains about 80 miles west of Maltahoehe, and near the farm Jsabis 50 miles west of Rehoboth. Since plants are already in private cultivation, and in order to obviate confusion, I am retaining Mr. Triebner's temporary manuscript name of *A. Carowii*.

This new *Aloe* is a very distinctive species in the Section *Serrulatae*, allied to *A. variegata* L., *A. Dinteri* Berger, and *A. Sladeniana* Pole Evans.

A. Carowii is a small plant, with rosettes only about 7 cm. high, and with usually about 6 leaves, whereas *A. variegata* is a much larger plant, with a much thicker more fleshy peduncle and lower inflorescence. In *A. variegata* the leaf margins and keel are crenate, whereas in *A. Carowii* they are distinctly though finely denticulate. In this respect *A. Carowii* resembles *A. Dinteri* but the latter has considerably longer thinner leaves, and a much more branched inflorescence. (*Vide Fl. Plants S.A.* Part 64, Plate 637, Oct. 1936.) The plant figured in *Fl. Pl. S.A.* (l.c.) is a young one ; it might be recorded here, that fully-grown plants of *A. Dinteri* produce up to 3 inflorescences, each with 5—8 branches. I have not seen material of *A. Sladeniana*, but from the published description it is a very different plant.

The inflorescence of *A. Carowii* is mostly simple or bi-furcate, reaching a height of 50 cm.—a surprisingly tall inflorescence from such a small rosette. Mr. Triebner states that one of his largest plants produced a 4-branched inflorescence, but that usually the inflorescence is only 1—2 branched. The species suckers and forms groups, while another interesting character is that the bracts are only 1-nerved.

Mr. Triebner states that he has found plants of *A. Carowii* growing only on quartz hills under bushes, the largest having rosettes only 4 cm. high, but in cultivation rosettes reach a height of 7 cm.

The species is described from material and notes furnished by Mr. Triebner, and from a plant which flowered in my collection in Johannesburg in January and November 1937, and again in February 1938. On the first two occasions the inflorescence was simple, while in February 1938 it was bi-furcate, as is illustrated on the accompanying Plate.

Description: Plant succulent, acaulescent, suckering and forming groups. *Leaves* about 6, sub-trifarious, up to 7 cm. long, 3—4 cm. broad at base ; upper surface concave to broadly " V " shaped in cross section, green, with numerous small white spots throughout, the spots irregularly scattered ; lower surface convex, copiously white spotted throughout, slightly carinate towards apex, the keel armed with a few small hard white teeth ; margins with a thin white rather cartilaginous edge armed with hard white teeth about 1 mm. long, 2—5 mm. distant. *Inflorescence* simple or 1—2 branched below the middle, up to 50 cm. high including the raceme. *Peduncle* slender, 6 mm. diam. low down, with a few sterile bracts which are ovate-acute, about 5 mm. long and broad, thin scarious, whitish, 1-nerved in median line. *Raceme* sub-laxly cylindric-acuminate, about 18 cm. long, 7 cm. broad, 30—40 flowered, the youngest buds sub-erect and denser, older ones more distant and more horizontally disposed, with the lowest open flowers cernuous. *Bracts* about 6 mm. long, 4 mm. broad at base, narrowly acuminate thin sub-scarious white

Fig. 1. Fig. 2. Fig. 3.

Plate 37. *Aloe Carowii*, Reynolds.

Fig. 1. Plant ex 30 miles east of Nauchas, S.-W. Africa, fl. 15 November, 1937, in the author's garden in Johannesburg. Height 48 cm.

Fig. 2. The same plant fl. 7 February, 1938.

Fig. 3. Flowers 1/1 from bud to post-pollination stage.

with one pronounced nerve in median line. *Pedicels* the colour of the perianth, the lowest 17 mm. long, rather horizontally disposed. *Perianth* nearest Peach-Red (R.C.S.I.), paler underneath, slightly greenish at mouth, 30 mm. long, with a sub-globose basal swelling 7 mm. diam., constricted to 5 mm. above the ovary, thence slightly decurved and enlarging to about 8 mm. at the throat, the mouth rather closed. *Outer segments* free for 7 mm., with 3 greenish nerves, apices sub-acute. *Inner segments* free but dorsally adnate to the outer to within 7 mm. of apex, the free portion with pale margins and a rose coloured keel, the apices more obtuse than the outer. *Filaments* pale rose, the anthers scarcely exserted. *Stigma* at length exserted 1 mm. *Ovary* green, 6 mm. long, 3 mm. diam.

PLANTAE NOVAE AFRICANAE.

"Ex Africa semper aliquid novi."—*Pliny.*

SERIES X.

By Captain T. M. Salter, R.N. (Ret.).

Oxalis exserta, Salter (Oxalidaceae), § Lineares.

Planta parva erecta, dense pubescens, 4—10 cm. alta. *Bulbus* anguste ovoideus, saepe 2 cm. longus, tunicis satis tenuibus brunneis : bulbilli stolonum subterraneorum apicibus terminaliter producti. *Rhizoma* 4—7 cm. longum, squamis numerosis indutum, stolonibus lateralibus nonnullis squamelliferis, ad 20 cm. longis, e squamorum axillis exorientibus. *Caulis* 1—7 cm. longus, squamis paucis amplexicaulibus pubescentibus et interdum foliis caulinis 1—2 instructus. *Folia* satis numerosa, ad caulis apicem aggregata : petioli graciles, 0·5—1·5 cm. longi : foliola 3, linearia vel oblonga, emarginata, subconduplicativa, 0·6—1 cm. longa, saepe glauca, utrinque pubescens, ciliata, ecallosa. *Pedunculi* pauci, folia aequantes vel paulum longiores, bibracteati bracteis subulatis calycem imbricantibus. *Sepala* late lanceolata, subacuta, 4·5—5 mm. longa, ecallosa. *Corolla* rosea, tubo subcylindrico pubescente, obscure luteo : petala 1·7—2·2 cm. longa, e basi anguste unguiculata, superne obovata vel anguste obovata. *Filamenta* (parte connata inclusa) minora 5—8 mm. longa, majora 8—13 mm. longa, sparse glandulosa, longissima inaequalia, valde exserta. *Ovarium* dense pubescens, loculis 2-ovulatis : styli glandulosi, sicut stamina, longissimi e corollae tubo exserti. (v.v.s., v.v.c.)

Hab. Namaqualand. Two miles north of Louwpoort. *Salter* 4589 (*type* in Bolus Herbarium) ; 12 miles north of Concordia, *Salter* 5536 ; near Kamieskroon, *L. Bolus*, B.H. 19198, *Salter* 855, 867, 1547 ; between Kamieskroon and Springbok, *Salter* 1405, 1406B, 1469 ; Springbok, *Salter* 901A, 906 ; Steinkopf, *Salter* 5544.

An affinity of *O. linearis*, Jacq. and also of *O. xerophila*, Salter. It differs from both in its habit of usually spreading by means of bulbilli produced at the tips of long lateral subterranean stolons, 20 cm. or even more in length and in the glaucous leaflets which are pubescent on the upper surface as well as the lower. The pubescence is much softer than that of *O. linearis* and the leaflets do not taper towards the apex as in *O. xerophila.*

It flowers from April to June, but rather sparingly. Several large colonies have been seen without any trace of flowers and bulbs from these, brought into cultivation, have, after several years, only produced a few flowers. It cannot be definitely stated that this species always produces

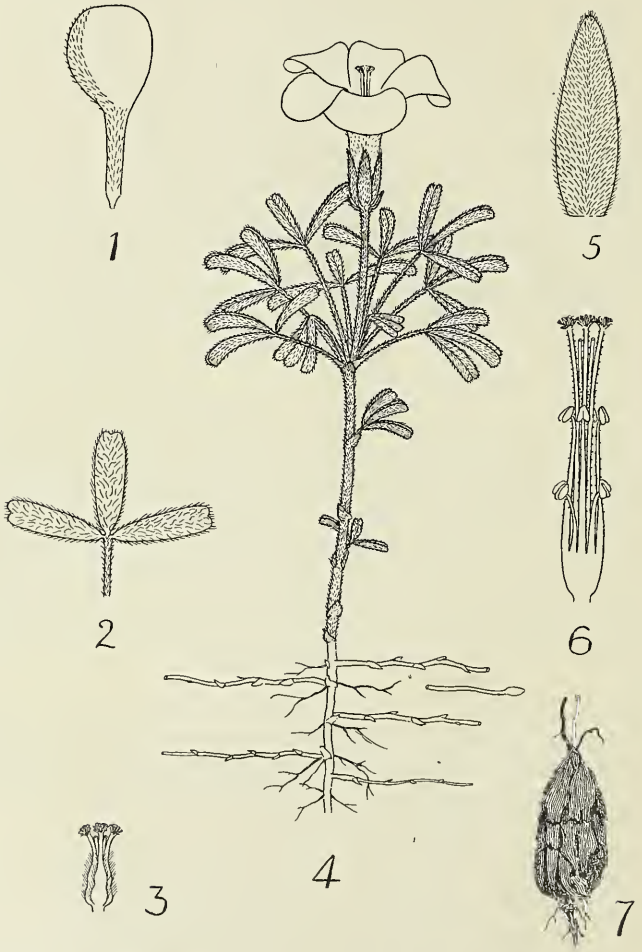

Fig. 1. *Oxalis exserta*, Salter. 1. Petal × 1½. 2. Leaf, upper surface × 2. 3. Gynaecium × 3. 4. Plant × 1½. 5. Sepal × 6. 6. Androecium × 3. 7. Bulb, natural size. (*Salter* 4589). *Del.* T. M. Salter.

underground stolons and it is possible that it does so only in its younger stages. No structural differences can, however, be found in the few plants where this character appeared to be absent. One bulb produced a double flower in cultivation.

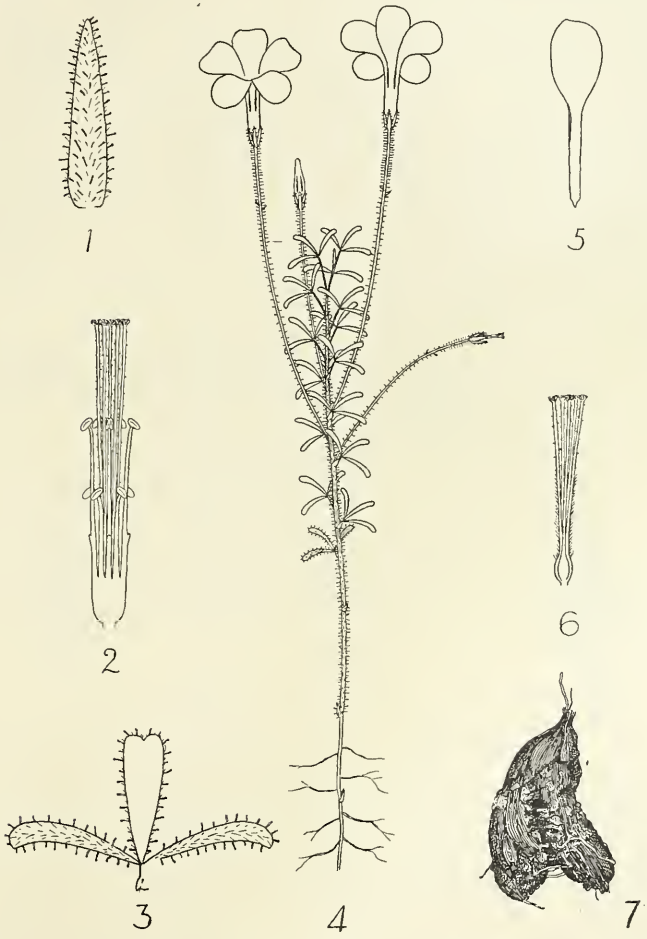

FIG. 2. *Oxalis giftbergensis*, Salter. 1. Sepal × 8. 2. Androecium × 4. 3. Leaf × 4. 4. Plant, natural size. 5. Petal × 1½. 6. Gynaecium × 4. 7. Bulb natural size. (*Salter* 7263). *Del.* T. M. Salter.

Oxalis giftbergensis, Salter (Oxalidaceae), § Sessilifoliatae.

Planta erecta gracilis, 6—20 cm. alta, pilis simplicibus brevibus capitatisque longioribus, saepe pluricellularibus omnino dense pilosa. *Bulbi* plus minusve ovoidei vel oblongi, 2—3 cm. longi, interdum tortuose conglomerati, tunicis rigidis gummeis atris. *Rhizoma* glabrum, pallidum, fere 5—10 cm. longum, squamis paucis amplexicaulibus indutum. *Caulis* in dimidio superiore foliatus. *Folia* caulina, inferiora subsessilia, petiolis squamiformibus, superiora breviter petiolata, petiolis filiformibus, ad 1·2 cm. longis : foliola 3, sessilia, lineari-cuneata, conduplicativo-falcata, emarginata, 4—9 mm. longa, supra glabra, infra pubescentia, margine nervoque medio inferiore glanduloso-pilosa, ecallosa. Pedunculi axillares, 2—6 cm. longi, dimidio superiore bibracteati bracteis inconspicuis minutis alternantibus. *Sepala* lanceolata, interdum paulum attenuata, 2·5—4 mm. longa, ecallosa. *Corolla* 1·9—2·5 cm. longa, glanduloso-pilosa, rosea, tubo subcylindrico obscure luteo, plerumque in parte superiore lineis 5 angustis purpureis longitudinaliter ornato : petalorum laminae oblique obovatae quam unguiculae angustae breviores. *Filamenta* glabra (parte connata inclusa), minora 5—7 mm., majora 8—11·5 mm. longa, minute dentata. *Ovarium* vix 1 mm. longum, ad apicem pubescens, ecallosum, loculis 1-ovulatis, stylis inferne pubescentibus, superne sparse glandulosis.

Hab. Van Rhyn's Dorp Div. : Gift Berg, on western slopes and summit, Salter 7263 (type in Bolus Herbarium), 7294, 30 May 1938.

A close affinity of *O. porphyriosiphon,* Salter (described in Vol. II, p. 14 of this Journal), but differing in the shape of the corolla and colour of the tube. The laminae of the petals are proportionately narrower, the dull yellow tube is practically cylindrical, perceptibly longer than the laminae and the teeth on the filaments are smaller. The leaflets are also consistently narrower in this species.

Oxalis Nortieri, Salter (Oxalidaceae), § Simplicifoliae.

Planta glabra, heterophylla, ad 9 cm. alta, caule non exserto. *Bulbus* ovoideus vel subfusiformis, ad 2·5 cm. longus, tunicis atris rigidis. *Rhizoma* fere 4 cm. longum, squamis membranaccis, praecipue ad apicem indutum. *Folia* basalia, juvenilia, primo c bulbillis exorta, parva, semper trifoliolata, proxime sacpe unifoliolata : in plantis maturis majora, omnino unifoliolata, petiolis compressis 2—6 cm. longis : lamina plus minusve elliptica vel obovata, basi subtruncata, crassa, 2·5—3·5 cm. longa, 1·2—1·8 cm. lata, glabra vel hirsuta, in sicco utrinque impresso-punctata, infra nervo medio conspicuo induta. *Pedunculi* uniflori, pauci, petiolis fere aequantes, supra medium bibracteati bracteis subulatis alternantibus, ad 2·5 mm. longis. *Sepala* late lanceolata,

7—8 mm. longa, pallida, minute penicillata. *Corolla* fere 1·7 cm. longa, roseo-purpurea, tubo infundibuliforme luteo : petala late subcuneata, basin versus attenuata, vix unguiculata, antice truncato-retusa, oblique acutiuscula. *Filamenta* majora 7·5 mm. longa, inferne sparse villosa,

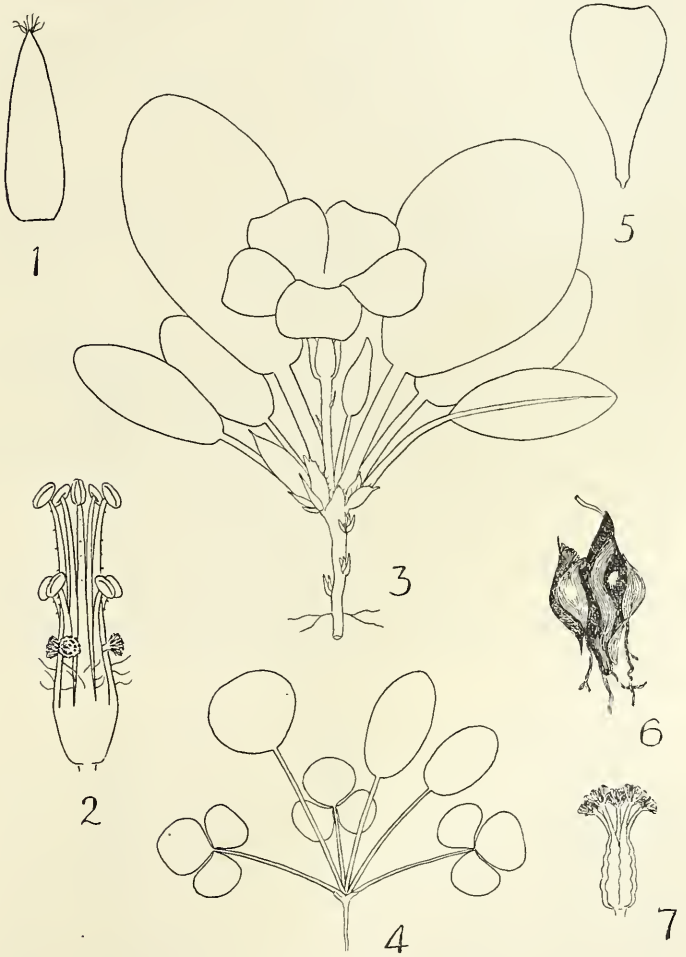

Fig. 3. *Oxalis Nortieri*, Salter. 1. Sepal × 4. 2. Androecium × 5. 3. Plant × 1½. 4. Plant produced from bulbil in the first year × 1½. 5. Petal × 1½. 6. Bulb, natural size. 7. Gynaecium × 5. (B.H. 21532). *Del.* T. M. Salter.

superne sparsissime glandulosa, edentata. *Ovarium* 2 mm. longum, sicut styli brevissimi glabrum, loculis 10—12-ovulatis. *Forma brevistylosa solum visa.* (v.s.s., v.v.c.)

Hab. Cape Province: Willowmore, *P. L. Nortier* (Bolus Herbarium 21532, *type*) July. Oudtshoorn Div.: Little Buffels Klip, *Taylor* 450 (a form with hirsute leaves), June.

This exceptionally interesting species illustrates the process of the simplification of leaves which seems to be taking place in the genus Oxalis. The great majority of the South African species have trifoliolate leaves, several are multifoliolate, but only four species with simple leaves have hitherto been found.

Dr. P. F. Nortier kindly sent me dried specimens of this plant with bulbs and well formed bulbils in 1935 and in these specimens all the leaves were unifoliolate. The bulbs and bulbils were removed from the specimens and planted in a pot, but, as it was afterwards found, the mature bulbs died. The following year a number of small plants appeared with darkish green trifoliolate leaves and it was at first thought that some error had occurred in the number label in the pot (one of several hundreds in which I was then cultivating Oxalis. A little later on, however, the plants began to produce small simple leaves as well. (See Fig. 3, 4.)

In 1937 the plants were more robust and all the leaves were simple, but they did not flower. At the same time the new bulbils, formed in 1936, began to produce trifoliolate leaves, but the young plants were small and weak and only one of them developed a simple leaf.

As the plants, like a great many of the Oxalis, were not happy in a pot, they were transferred to the nursery beds at the Nat. Bot. Gardens at Kirstenbosch. On unpotting them it was found that the original bulbs sent by Dr. Nortier had died and that the 1936 plants had grown from the bulbils. In the current year one of the mature plants produced flowers in May.

Oxalis oligophylla, Salter (Oxalidaceae), § Oblongae.

Planta gracilis, ferme glabra, 12—16 cm. alta. *Bulbus* plus minusve ovalis vel oblongo-ovalis, saepe deformis, 1·5—3 cm. longus, tunicis rigidis gummosis atris. *Rhizoma* 2—4 cm. longum, rare sparse squamelliferum. Folia 1—2, rarius 3, basalia: petioli graciles, 6—12 cm. longi, in parte inferiore purpurascentes et interdum sparsissime glandulosi: foliola 3, sessilia, anguste linearia, conduplicativa, praecipue ad apicem falcata, 4—6 cm. longa, ad 2 mm. lata. *Pedunculi* pauci, 12—15 cm. longi, apice bibracteati bracteis minutis calycem imbricantibus. *Sepala* oblongo-lanceolata, 4—5 mm. longa, marginem versus purpurascentia, saepe minute purpureo-lineata, interdum sparse pubescentia, apice minute

penicillata et callis 2 inconspicuis ornata. *Corolla* 1·4—1·9 cm. longa, alba, tubo infundibuliforme lutescente : petala e basi unguiculata superne obovata, indistincte purpureo-nervata. *Filamenta* (parte connata in-

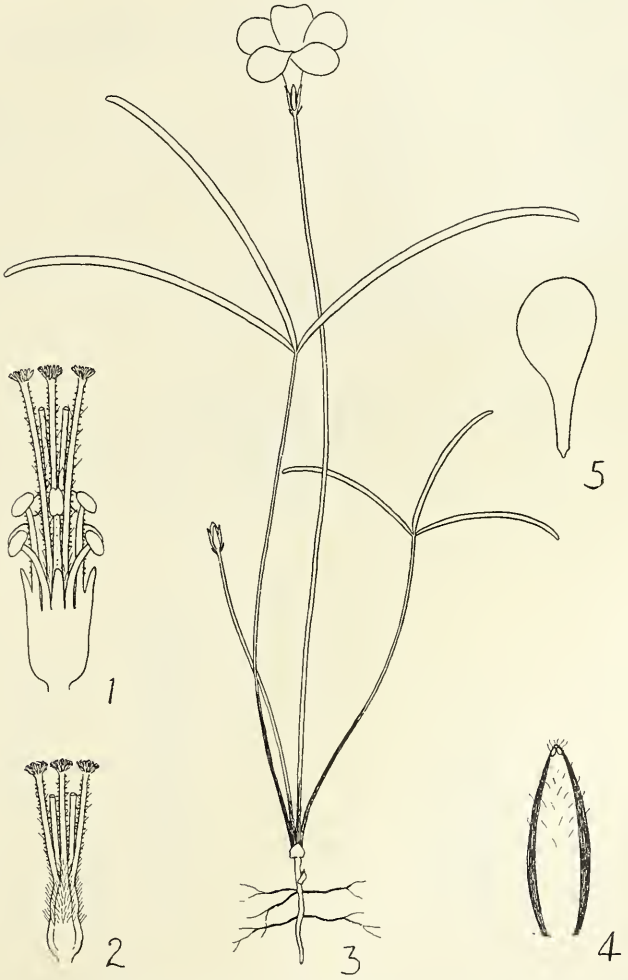

Fig. 4. *Oxalis oligophylla*, Salter. 1. Androecium × 8. 2. Gynaecium × 8. 3. Plant, natural size. 4. Sepal × 6. 5. Petal × 1½. (*Salter* 7266). *Del.* T. M. Salter.

clusa) minora 2·5—3·5 mm., glabra, majora 3·5—6 mm. longa, minute glandulosa, dentibus conspicuis subacutis. *Ovarium* 1·5 mm. longum, in dimidio superiore pubescens, loculis 2—3-ovulatis: styli satis dense glandulosi, pilis simplicibus admixtis. (v.v.s.)

Hab. Cape Province: Van Rhyn's Dorp Division, west slope of Gift Berg, near summit, about 1800 ft., 30 May 1938, *Salter* 7266, (*type* in Bolus Herbarium).

This very distinct species has no known affinity among the South African Oxalis. In general appearance it bears some superficial resemblance to the forms of *O. Smithiana*, E. and Z., with very narrow leaflets, but here the long narrow leaflets are entire, not bifurcate, and the hard black gummy bulbs, which are of no very definite shape, are entirely different.

All the plants found, though situated on a fairly open hillside, were growing up through small shrublets with only the white flowers visible, the leaves being entirely concealed and the rather shallow bulbs well protected from the sun.

Oxalis tenuipes, Salter (Oxalidaceae), § Lineares.

Planta gracilis, 15—30 cm. alta, interdum caespitosa. *Bulbi* saepe congesti, anguste ovoidei, apice acute rostrati, fere 3 cm. longi, tunicis papyraceis rugosis castaneis. *Rhizoma* gracile, saepe 4—8 cm. longum, squamis paucis parvis instructum. *Caulis* gracillimus, glaber, atroviridis, nunc breviter exsertus, nunc in umbrosis ad 45 cm. longus. *Folia* plerumque 10—14, caulis apice aggregata, omnino glabra, petiolis filiformibus, 2—6 cm. longis: foliola 3, sessilia, linearia, 1·2—2 cm. longa, 1—2 mm. lata, minute emarginata, lobulis rotundatis, apice callis 2 parvis ornata. *Pedunculi* complures apicales graciles, foliis paulum superantes vel 2-plo longiores, inferne glabri, in dimidio superiore, praecipue ad apicem, glanduloso-pilosi, plerumque bibracteati bracteis minutis alternantibus linearibus, parte superiore rubro-callosis. *Sepala* lanceolata, ad apicem attenuata, 4—4·5 mm. longa, sparse glandulosa et ciliata, callis 2 parvis apicalibus rubris induta. *Corolla* 2—2·5 cm. longa, roseo-lilacea, tubo angustę infundibuliforme glanduloso luteo, in faucibus distincte purpureo-ocellata: petala e basi anguste unguiculata lamina aequante, superne plus minusve obovata, vix oblique truncata, ad marginem exteriorem glandulosa. *Filamenta* (parte connata inclusa) minora 4—6 mm. glabra, majora 6—8 mm. longa, sparse glandulosa, vix gibbosa, longissima satis inaequalia. *Ovarium* 2 mm. longum, in dimidio superiore pubescens, ecallosum, loculis 5-ovulatis, stylis inferne pubescentibus, superne glandulosis. *Capsula* oblonga, fere 5·5 mm. longa. (v.v.s.)

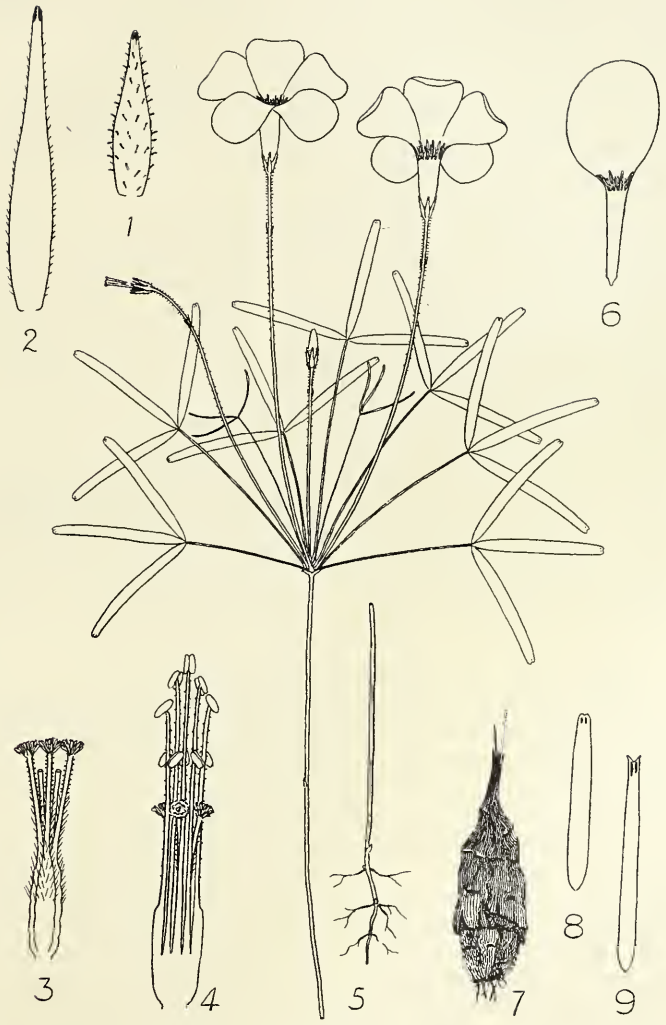

FIG. 5. *Oxalis tenuipes*, Salter. 1. Sepal × 6. 2. Sepal of var. β × 6. 3. Gynaecium × 6. 4. Androecium × 6. 5. Plant, natural size. 6. Petal × 1½. 7. Bulb, natural size. 8. Leaflet × 1½. 9. Leaflet of var. β × 1½. (*Salter* 7267). *Del.* T. M. Salter.

Var. β. **biapiculata.** *Foliola* ad apicem attenuata, valde emarginata, lobulis minutis acutis divergentibus, basi elongate callosis. *Pedunculi* glabri. *Sepala* lineari-lanceolata, angustissime attenuata, 6—8·5 mm. longa, glabra. *Petala* plerumque angustiora.

Hab. Cape Province : Van Rhyn's Dorp Div.: Gift Berg, about 2000 ft. in rather shady places, *Salter* 7267 (*type*). Var. β. Clanwilliam Div. : Warm Baths, *F. Bolus*, Bol. Herb. 14605 (*type*), *G. Edwards* 231. Flowers June. *Types* in Bolus Herbarium.

A very distinct shade-loving species which is probably nearest to *O. phloxidiflora*, Schlechter (and *O. Malleyi*, R. Knuth, which is in my opinion synonymous.) *O. tenuipes* is, however, a larger and much more frail plant, the purple-eyed corolla being so fugitive as to wilt a few minutes after specimens are gathered. It also differs in its more elongate bulb, with softer tunics, glandular pilose peduncle, and open unfolded leaflets which do not widen towards the apex. Var. β. which is only known to me from the dried specimens quoted, differs in some important particulars, but its essential characters show that it is so closely related to the typical form that it cannot be given specific rank.

The species is very local as far as is at present known, but it must be admitted that the 80-mile range of mountains between the two localities given is almost entirely unexplored in the botanical sense. I have chosen my own collecting as the type as I have had the opportunity of observing it in the living state and making a complete examination of the floral characters.

Oxalis tenuis, Salter (Oxalidaceae), § Lineares.

Planta gracilis, 7—10 cm. alta, caule exserto, partibus herbaceis (nisi tamen foliolis) pubescentibus pilisque admixtis capitatis, plerumque pluricellularibus pilosis. *Bulbus* ovoideus, apice acutus, 1·5—2 cm. longus, tunicis exterioribus subrigidis atro-brunneis. *Rhizoma* gracile, fere 2—4 cm. longum, squamis paucis pallidis indutum. *Caulis* erectus, 4—7 cm. longus, rare ramosus, squamis vel foliis 1—2 instructus. *Folia* caulis apice aggregata, 6—10, plerumque unicum caulinum, petiolis filiformibus 0·8—1·4 cm. longis : foliola 3, sessilia, anguste linearia, conduplicativa, leviter falcata, emarginata, 1—1·5 cm. longa, 1—1·5 mm. lata, glabra vel infra sparsissime pubescentia. *Pedunculi* terminales, 1·5—2·5 cm. longi, bracteis 1—2 minutis, vel ebracteati. *Sepala* lanceolata, 2·5—3 mm. longa, ciliata, ad apicem nigrescentia, ecallosa. *Corolla* 1·4—1·7 cm. longa, glandulosa, alba, tubo satis late infundibuliforme sordide luteo : petala subcuneata, inferne leviter attenuata, superne rotundata, 6—8 mm. lata. *Filamenta* (parte connata inclusa) minora 2—3 mm., glabra, majora 3—5·5 mm. longa, glandulosa, dentibus

obtusis fere 0·4 mm. longis. *Ovarium* vix 1 mm. longum, in dimidio superiore pubescens, loculis 1-ovulatis, stylis inferne pubescentibus, superne glandulosis.

Hab. Cape Province : Van Rhyn's Dorp Div. ; Western slope of Gift Berg, *Salter* 7260 (*type* in Bolus Herbarium).

This species appears to be an affinity of *O. tenella,* Jacq., but the stem is more rigid and the leaflets narrower. It also differs in having an ecallose ovary in which the chambers are only 1-seeded, and which does not elongate beyond the calyx in the fruiting stage. The hairs on the upper part of the styles are gland-tipped, but not pluricellular as in *O. tenella.*

Only one small colony was observed and this in a position partially shaded by bushes.

Lessertia miniata, Salter, Leguminosae (Papilionaceae), § Galegeae) *Herba* perennis diffusa, partibus herbaceis (nisi tamen legumina. sparse strigosis. *Caules* saepe numerosi, laxi, procumbentes ad 1 m longi, sparse ramosi, internodis satis longis. *Folia* 4—8 cm. longa, petiolis ad 8 mm. longis, 8—11-jugis : foliola breviter petiolulata, linearia vel oblonga, acuta, 1—2 cm. longa, apice brevissime apiculata, supra glabra, subtus sparse strigosa. *Stipulae* oblique ovato-lanceolatae, fere 4 mm. longae, ciliatae. *Pedunculi* axillares, 8—12 cm. longi, apicem versus 6—9-flori, racemo sublaxo, floribus adscendentibus : bracteae ovatae, ad 2 mm. longae : pedicelli 3—5 mm. longi. *Calyx* 5—6 mm. longus, segmentis anguste ovato-deltoideis, fere 2 mm. longis, intus strigosis. *Petala* miniata (in sicco purpurea) : vexillum fere 1·2 cm. longum, distincte unguiculatum, lamina suborbiculata, apice emarginata vel retusa : alae oblongae, fere 1·1 cm. longae, lobo posteriore obtuso, ungua valde obliqua : carina alis aequilonga, lobis obtusis, ungua laminae dimidio aequante. Ovarium sparsissime strigosum vel glabrum, pluriovulatum, stylo superne minute barbato. *Legumen* inflatum, ellipticooblongum, aequilaterale, transverse nervatum, glabrescens, 2—2·8 cm. longum, 0·8—1 cm. latum. (v.v.s.)

Hab. Cape Province : Cape Peninsula, near Slangkop, *Salter* 7104 (*type* in Bolus Herbarium) ; near Cape of Good Hope, *Salter* 7109 ; South slope of Chapman's Peak, *Salter* 7083 ; between Buffels Bay and Cape Point, *L. Bolus* Bol. Herb. 22207 ; also in Kew Herbarium without exact locality, *Mundt* 58 (Hort. Kew.) ; P.b.sp., *Mundt and Marie ;* P.b.sp., *Grey ;* C.B.S., *Bowie.* Flowers November.

A lax plant with numerous long weak procumbent stems emerging from a common rootstock. It is an affinity of *L. physodes,* Eck. and Zey. which is however an erect shrubby species, the obovate vexillum having no ap-

preciable claw. *L. miniata* also differs in its laxer raceme, narrower and more numerous leaflets, more symmetrical legume, larger flowers and differently shaped vexillum. No record appears to have been kept of the colour of the flowers in *L. physodes*.

I am indebted to Professor R. S. Adamson, of Cape Town University, for kindly comparing my plant with the four undetermined specimens in Kew Herbarium quoted above and he informs me that they are identical with it.

No locality records have been left by the old collectors and it cannot therefore be certain that this species is confined to the Cape Peninsula, where it is only known in the southern part. Though not a purely maritime species, it does not appear to occur at altitudes of over 300 ft., and never far from the sea. By no means uncommon, it has probably been overlooked by modern collectors owing to the superficial resemblance of the brick red flowers to those of *Indigofera candicans*, Ait.

Pelargonium Pillansii, Salter (Geraniaceae), § Polyactium.

Herba perennis. *Tuber* pastinaciforme, lignosum, ad 16 cm. longum. *Caulis perennis* brevis, nunc omnino subterraneus, nunc breviter exsertus. *Folia radicalia* 3—6, e caule perenne exorientia, late divergentia, prorsus proterantha, glauca, glabra, petiolis 5—12 cm. longis : lamina in ambitu ovato-deltoidea, 4—11 cm. longa, 4—8 cm. lata, palmate tripartita vel profundissime trilobulata : lobi saepe ad rachim bipinnatipartiti, segmentis cuneato-oblongis, profunde laciniatis dentatisque, ultimis acutis rubro-mucronatis : stipulae parvae semiadnatae.

Caulis annuus erectus, teres, 6—13 cm. longus, basi ad 4 mm. latus, infra internodos leviter turgidus, ramis paucis suberectis, sicut partes omnes herbaceae (nisi tamen folia radicalia) dense glanduloso-puberulus, *Folia caulina* pauca, alternantia, leviter canaliculata, glauca, 2·5—3·5 cm. longa, ad 1·3 cm. lata, profunde pinnatifida, lobis obcuneatis acutis, saepe 1- vel 2-dentatis, rubro-mucronatis : petioli anguste cuneati : stipulae brevissime adnatae, lanceolatae vel obcuneatae, ad 7 mm. longae, rubro-dentatae. *Pedunculi* axillares, 12—16 cm. longi, bracteae ovatae, acuminatae, 5—6 mm. longae : pedicelli 10—16, ad 5·5 cm. longi, tubo nectarifero prope ad basin extenso. *Calyx* fere 1 cm. longa, segmentis

Fig. 6. *Pelargonium Pillansii*, Salter. 1. Tuber with the perennial stem and a portion of the annual stem attached × ½. 2. Annual stem and inflorescences × ½. 3. Flower, front view × 2. 4. Flower with petals removed, side view × 2. 5 & 9. Lower calyx segments, outer view × 2. 6 & 8. Lateral calyx segments, outer view × 2. 7. Upper calyx segment, outer view × 2. 10. Lower petal × 2. 11. Upper petal × 2. 12. Androecium, from within × 5. 13. Upper portion of androecium, from outside × 5. 14. Gynaecium × 2. 15. Radical leaf × ½. (*Salter* 6453). *Del.* W. F. Barker.

Fig. 6.

oblongis acutis rubro-mucronatis, interdum reflexis. *Petala* 5, subaequalia, 1·3—1·4 cm. longa, inferiora spathulata, superiora latiora, subcuneata, pallide sordideque luteola, inferiora indistincte purpureo-ornata. *Stamina* 7, staminodia 3 : antherae oblongae, polline flavo. *Ovarium* dense albo-sericeum. (v.v.s., v.v.c.)

Hab. Cape Province : Cape Peninsula ; Lion's Mountain, *Salter* 6453 (*type* in Bolus Herbarium), 6574, *Pillans* 4172, 8527, *Levyns* 6413 : Bellville Div. : Tygerberg, *Salter* 7189 (in leaf).

P. Pillansii differs from other species in the section Polyactium in having glaucous leaves and in the remarkably long interval between the production of the radical leaves and the flowering stem. The comparatively large radical leaves appear from May to October and are entirely glabrous, dying away completely before the production of the flowering stem which emerges about March and usually flowers in April. With the exception of the radical leaves, the stem and all the herbaceous parts are glandular-puberulous and, owing to the dry season in which they appear, the cauline leaves seem to be often poorly developed and quickly shrivel. As is the case with *P. triste*, Ait., the radical leaves of the younger plants are much less deeply laciniate than those of the mature plants.

Though not common, it occurs in several places on Lion's Mountain and the Tygerberg Hills, and it is curious that it should have escaped notice until Mr. N. S. Pillans obtained a tuber and cultivated it in 1920. The dull creamy-yellow flowers are, however, not very conspicuous and it appears to flower but rarely. A plant which appears to be this species has recently been found on the summit of the Gift Berg in Van Rhyn's Dorp Division.

MYRICA MOSSII.

(With Plate 38.)

By J. Burtt Davy.

Specimens of a species of Myrica from the Witwatersraud, Transvaal, which did not agree with any of those described in the "Flora Capensis," were loaned to me by the late Professor C. E. Moss for publication in the pages devoted to *Specierum et Varietatum Novarum Descriptarum Diagnoses*, in the "Transvaal Flora." A description was drawn up for the purpose and it was thought that it had been sent to the printers, but when the "Flora" appeared it had not been included so that the name *Myrica Mossii* appears on page 435 as a *nomen nudum*. A description has now been drawn up by my assistant, Mr. P. G. Beak, who on this account would be credited with the name but for the fact that it had already appeared in print as *Myrica Mossii* Burtt Davy.

Myrica Mossii Burtt Davy sp. nov. [Myricaceae]; affinis *M. lineari* C. DC. et *M. glabrissimae* A. Chev., sed ramulis sicco griseobrunneis satis dense pubescentibus, foliis subsessilibus mucronatis subtus dense glandulosis vernis lateralibus utrinque 8—10 subtus indistinctis praecipue differt.

Ramuli striati, sicco griseo-brunnei, breviter et satis dense pubescentes, parce glandulis fulvis applanatis muniti, hornotini densifoliati. *Folia* exstipulata coriacea decidua, subsessilia, lineari-oblanceolata, usque ad 6 cm. longa et 0·75 cm. lata, plerumque 4·5—5·5 cm. longa et 0·5—0·6 cm. lata, apice acuta vel subacuta saepissime mucronata, ad basin cuneatam sensim attenuata, margine integra vel rarissime apicem versus 1—2-dentata, utrinque primum praesertim in costa sparsissime pubescentia, mox glabrescentia, supra juventute glandulis perpaucis fulvis, subtus dense glandulis fulvis applanatis persistentibus in puteis brevibus insidentibus instructa; costa valida subtus prominens; nervi laterales tenues, utrinque 8—10, a costa sub angulo circiter 45° divergentes, juxta marginem arcuatim conjuncti, subtus valde obscuri, supra cum rete venarum prominuli. *Flores* ut videtur dioici, ♂ haud visi. *Spicae* ♀ solitares axillares laxiflorae, 0·5—1·4 cm. longae; rhachis breviter pubescens parce glandulosa; bracteae late ovatae, circiter 1 mm. longae, margine ciliatae, extra glandulosae atque leviter pubescentes; squamae

hypogynae 4, ciliatae, extra glandulosae ; ovarium visu ob glandulas ceriferas verrucosum, stylis 2 complanatis terminatum. *Fructus* globosus, circiter 3 mm. diametro, sicco inter verrucas nigrescentes albido-ceraceus.

S. Africa. Transvaal : Witwatersrand, Witpoortjie Kloof, streamside, *C. E. Moss* 6653, with flowers, February 1922 ; *C. E. Moss* 6828, with fruits, April 1922, types, in Hb. Mus. Brit.

At first sight, the leaves of this species might appear to be distinctly petiolate : on examination with a lens, however, the insensibly narrowed base of the lamina is seen to extend almost to the junction of leaf and branchlet, the true petiole being extremely short.

This is not the same species as the plant recently described from Southern Rhodesia as *M. microbracteata* H. Weimarck, which differs in its smaller, serrate leaves, densely glandular above as well as beneath, in its very minutely pubescent branchlets, and in being monoecious, with longer spikes and shorter bracts.

PLATE 38. *Myrica Mossii*, Burtt Davy.

A NEW SPECIES OF COMMELINA.

By J. Burtt Davy.

Commelina Rogersii Burtt Davy sp. nov., affinis (ut videtur) *C. filifoliae* K. Schum., a qua caulibus durioribus, foliis brevioribus, spathis pilosis breviter (nec longe) acuminatis, spathae nervis paucioribus, differt.

Herba perennis (?); *caules* lignosi, rigidi, teretes, puberuli, purpurascentes, circiter 30 cm. alti, basi 1·5 mm. diametro, internodiis infra longe exsertis, apicem versus vaginis foliaribus ± imbricatis obtectis. *Folia* puberula prominenter nervosa, vaginis brevibus 3—4 mm. longis, lamina subulata conduplicata rigida, 3—4 cm. longa, plicata ad medium circiter 1 mm. lata, utrinque attenuata, margine basin versus pilis nonnullis rigidis septatis instructo. *Spathae* falcatae breviter acuminatae, pilis albidis septatis instructae, simpliciter plicatae, 13 nervatae, 18 mm. longae, ad medium 6·5 mm. latae; pedunculus circiter 1 cm. longus. *Flores* atque *fructus* haud visi.

South Africa. Transvaal: Pietersburg, flg. April 1915 *Rogers* 14142 ! in Kew Herb., typus.

Perennial (?) herb; stems about 30 cm. high and 1·5 mm. diameter at base, woody rigid terete puberulent purplish; internodes long-exserted below, clothed above with the more or less imbricate leaf-sheaths. *Leaves* puberulent, prominently nerved; sheaths short 3—4 mm. long; blades 3—4 cm. long, subulate conduplicate, rigid, about 1 mm. broad in the middle when folded, tapering to both ends; basal margin with a few stout rigid septate hairs. *Spathes* falcate, shortly acuminate, pilose with whitish septate hairs, simply folded, 13-nerved, 18 mm. long, 6·5 mm. broad at the middle; peduncle about 1 cm. long. *Flowers* and *fruit* not seen.

From *C. subulata* Roth which, also, has narrow leaves, it differs in the more woody stems, shorter more rigid leaves, and larger spathes.

A NOTE ON A VISIT TO CHRISTIAAN HENDRIK PERSOON'S GRAVE.

(With Plate 39.)

By Professor J. L. M. Franken.

In conclusion to her translation of Fee's article on Persoon of 1846 which she published in *Nederlandsch Kruidkundig Archief* of 1894, Miss C. E. Destrée mentions a visit to Persoon's grave at the cemetery of Le Père Lachaise in Paris. This was in 1893. Doubt has been expressed whether the grave still existed, so I took advantage of my presence in Paris at the beginning of this year to make a personal investigation. Mr. Chenivesse, the conservateur of the cemetery, soon provided me with the necessary information. The grave of the famous mycologist, a South African, is still intact. It is situated in the " 32e Division 2 Sect. 1e Ligne, face 75, No. 35 du Chemin Gay." After 45 years, since the visit of Miss Destrée, it is even more delapidated and the inscription on the stone more effaced. The letters between parentheses are hardly legible :

PERSOO(N)
CHRETIEN HE(NRY)
BOTANISTE
(N)E AU CAP DE BON(NE ESPERANCE)
(DECEDE LE 15 NOVEMBRE 1836)

The stone is slanting and stooping from old age, but it is well protected by the surrounding monuments and by a shrub, which was probably planted on the grave long after Persoon's interment.

The date given of his decease varies. According to Günther Schmid (*Zeitschrift für Pilzkunde*, 1932), it was the 14th of November, 1836, as indicated in the *Archives du Département de la Seine et de la Ville de Paris*. The Registers of *Le Père Lachaise* give it as the 15th of November and in the obituary notice of the *Government Gazette* of 10th of March, 1837, as the 16th.

The Registers at Le Père Lachaise contain the additional information that the " Concession " at the above-mentioned cemetery was acquired by " M. de Fabricius, chargé d'affaires des Pays-Bas," the " exécuteur

testamentaire " of C. H. Persoon, and that Persoon died at No. 11 (eleven) Rue du Val de Grâce.

Mr. J. H. Verduyn den Boer, who published in the *Huisgenoot* of the 29th October and the 5th November, 1937, a translation of Fee's article on Persoon, added in conclusion a valuable bit of research in connection with Persoon's testamentary dispositions and his burial. He does not quote his sources, but he evidently followed up Schmid's indication of the *Archives du Département de la Seine et de la Ville de Paris.*

Verduyn den Boer says that Persoon's funeral was not unattended, as Fee had given to understand. The Reverend Montandu accompanied the hearse but did not hold a service at the grave. He received a fee of 80 francs. Persoon requested in his testament that he should be buried in a coffin of a more finished nature than the usual run of coffins ; that it should not be closed before two days had lapsed after his death " since I consider being buried alive as one of the greatest calamities which can befall a human being." He described the nature of the stone to be erected on his grave, together with the inscription, corresponding to what we now see on it. The stone had to be simple and vertical.

Through Mr. Verduyn den Boer's investigations and the finding of his testament the accepted theory about his dying in poverty has also been exploded. In his testamentary dispositions Persoon also indicates the sources from which his burial, the purchase of a grave and the erection of a tombstone had to be defrayed from investments in Government loans and from money " hidden in a little chest." After payment of these expenses he requests his executors to pay over the balance of his estate to his sister, Mrs. J. M. Storm, of Wynberg, or in case of her decease, to her children. She figures on the list of payments with a sum of 2,600 frs., but according to Mr. Verduyn this money was still in Paris in 1840.

These interesting details appeared in *Die Huisgenoot* after the correction of the page proofs of my *Uit die Lewe van 'n Beroemde Afrikaner, Christiaan Hendrik Persoon,* 1762-1836, *en sy vader Christiaan Daniel* (Annale van die Universiteit van Stellenbosch, XV, Reeks B, Afl. 4, Okt. 1937), otherwise I would have been only too glad to insert them in my work.

M. Chenivesse, the conservateur of Le Père Lachaise, told me that in 1936 there had been inquiries concerning the grave of Persoon by an official of the Museum in the Jardin des Plantes at Paris with a view of holding on the centenary of Persoon's death a " service commémoratif " at the grave. So far as he knows, M. Chenivesse says, this service did not take place. Anyhow it shows that Persoon is not forgotten at the Jardin des Plantes, where he used to obtain specimens for his herbarium.

PLATE 39. The grave of Christiaan Hendrik Persoon in Le Père Lachaise Cemetery, Paris.

THE INDEX TO THE ABORIGINAL, AFRICAN AND DUTCH NAMES OF THE PLANTS OF SOUTHERN AFRICA.

With references to the PLANTARUM AFRICÆ ET EXTRATROPICÆ by W. J. Burchell, compiled in the years from 1810 till 1815.

By MRS. H. M. MCKAY.

For permission to publish this Index, thanks are due to the Acting Director (J. S. L. Gilmour, Esq.) of the Royal Botanic Gardens, Kew, Surrey.

Among William John Burchell's MSS., preserved in the Library of the Royal Botanic Gardens, Kew, is a small book—$7\frac{1}{2} \times 4\frac{1}{2}$ ins.—consisting of 46 pages of which 12 are blank.

Strips of paper, varying in size from $\frac{1}{4}$ in. to $\frac{3}{4}$ in. in depth, are pasted on the pages. These strips contain the information as presented in this present publication, in columns 1, 2, 3 and 4.

In the original MSS. there is an average of 17 names to a page.

In presenting this Index, I have kept strictly to Burchell's spelling. In column 5, I have inserted the localities from the information taken from his " Catalogus Geographicus " to which he refers when he gives the numbers as in Column 4. To his localities I have added, within brackets, the names of the districts as we know them to-day.

For the permission to reproduce (Plate 40) the sketch of *Calodendron capense*, thanks are due to Mrs. Edward Burchell, Port Elizabeth. The sketch was made from material from the tree at Constantia which Burchell mentions in his " Travels," vol. I., p. 63, under the date 14th February, 1811. The following are Burchell's words :—

> " Close to the house stands a beautiful tree of Wilde Kastanje (Wild Chestnut), the trunk of which was fifteen inches in diameter, and thirty feet high below the branches. It well merits the generic name it has received (Calodendron, or " Beautiful tree "), and the colonial name is equally applicable, as, in the appearance of both the flower and the fruit, it very much resembles a horse-chestnut ; but in foliage it is different. This is the largest, and perhaps the only tree within a great distance of Cape Town. Close to it I saw a small tree of Gardenia Rothmannia, bearing a profusion of large and very sweet-scented flowers. These were an elegant sample of two trees of the Cape Forests."*

* A tree of *Calodendron capense* with a trunk about 3 feet in diameter still stands at Groot Constantia—possibly grown from a sucker of the tree Burchell saw. The *Gardenia Rothmannia* has disappeared, but I am informed that it was in existence about thirty years ago.—EDITOR.

INDEX TO THE ABORIGINAL AFRICAN AND DUTCH NAMES OF THE PLANTS OF SOUTHERN AFRICA. WITH REFERENCE TO THE PLANTARUM AFRICAE ET EXTRATROPICAE BY W. J. BURCHELL, COMPILED IN THE YEARS 1810 TILL 1815.

For those marked with * there are some notes available in South Africa.
For those marked with † there are some sketches.

			Cat. Geog. No.	*Locality.*
Absyńth	(Wilde alsen	Eriocephalus	1171	Karro Poort [Ceres].
Adam's Vyg		Ficus	5441	Rex's Garden [Knysna].
*Álsem	(Wilde	Artemisia Afra	1553	[Carnarvon].
Amándel	(Zoete	ubique in Coloniâ culta	7448	Ex hort. ad Bruyntjie rivier [Swellendam].
Amándel	(Wilde : Caffer chestnut	Brabeium stellatum	7175	Krombek's River [Swellendam].
*Anýs wórtel		Seseli (different from Anys wortel of Zwartland)	1286	Roggeveld [Sutherland].
Anýs wórtel	(bastaard Tchatachy	Thalictrum	1728	Klaarwater (Griquatown) [Hay].
*Appel	(Gift	Cucumis Africanus	960	Berg River [Paarl].
Aprikōōs	(Wilde	Ord. Eugeniae ?	4061	Rietfontein ; near Mossel Bay.
*Assegai hout	(Hassagy hout	Curtisia faginea	3601	In woody Kloof west of Grahamstown.
*Auteniqua landsche	Geelhout	Taxus elongata	5293	In Forest—at van der Wat's [Knysna].
*Bambos	(Berg	Restio giganteus B.	7139	Mountain Station [Riversdale].
*Bast	(Zwart	Royena lucida	3062/2	Upper part of Bruyntjies Berg [Somerset East].
*Baviaans touw		Cissus	3123	Boschberg [Somerset East].
Baviaans touw melk		Ord. Cynanchi	5396	In the forest Melkhout Kraal Knysna.
*Berg Lily		Amaryllis purpurea	5949/2	Western ridge of Postberg [George].

			Cat. Geog. No.	Locality.
Berg riet		Restio	7026	Mt. Station Riversdale.
Bésies	(Granáat	Fusanus ex. ord. Myrti	4260	near Uitenhage.
*Besjes	(Kraai	Royena lucida	5490	Between Melkhout Kraal and shore [Knysna].
*Beukenhout		Ardisia ?	3127	On Boschberg in the Forests [Somerset East].
*Bézem bosch		Rhus serræfolium B.	2697	Paardeberg [Malmesbury].
Bíton		Osteospermum	5553	Between Nysna Drift and Gówkamma Station [Knysna].
Bitter water Melóen	*vide* Water Melóen			
Blaauw Kéurboom		Psoralea pinnata	5492	Between Melkhout Kraal and shore [Knysna].
Blaauw lier	(an rectius	Blaauw Laurier : Laurús	7287	Between Buffeljagts River and Swellendam.
Bloem	(Gouds	Arctotis	1517	Tys Kraal [Ceres].
Boerbóomtjes	(vel Boerbóom	Schotia	3253/x	Western side of gt. Fish River [Border of Somerset East and Bedford].
Boerbóom	(Bosch	Schotia	4550	N. side of the lake Krakakamma
Boom	(Wilgen	Salix Gariepina	1637	Orange River [Prieska].
Bosch	(Brándenetél	Urtica	5401	By the quarry ; Melkhout Kraal [Knysna].
Bosch	(Harpúis	Othonna trifida	1347	Roggeveld.
*Bosch Hout	(Witte	Scleroxylon jacquini	5286	Forest Knysna.
Boschjesmans thée		Weinmannia ?	5520	" Houtbosch " [Knysna].
Bosch péper	(et Wilde péper	Piper Capense	5397	By the Quarry : Melkhout Kraal [Knysna].
†*Bosch	Rhénoster	Stoebe Rhinocerotis	1025	Babylonsche Toren [Caledon].
Bóter boom		Cotyledon fascicularis	6456	E. side of Gourits River [Riversdale].

			Cat. Geog. No.	Locality.
*Braam		Rubus	3180	Boschberg.
Braam		Rubus hypoleucus B.	2757	Carolus Poort [Colesburg].
*Brándenetél	(Bosch	Urtica	5401	By the Quarry ; Melkhout Kraal [Knysna].
Brándewyn bosch		Grewia flava	1716	Klaarwater—Griquatown [Hay]
†*Brood	(Hottentotsche	Testudinaria montana B.	2912	Mts. S.W. side of Graaff Reinet.
Búffels bal		Gardenia Thunbergia	4127	Riet River : tributary to Kariega River [Bathurst].
Buffel Doorn		Zizyphus bubalinus	1635 ; 3116	Orange River near Prieska and at Somerset E.
†*Búku	(Molókha	Croton gratissimum B.	2154	Klip fonteyn [Hay].
†*Chukwápo		Hypoxis obtusa B.	2247/2	Between Thermometer Fontain and Pintado Fon. [E. of Kuruman].
Dákka		Leonotis—leonurus	2108	Doorn River [Hay].
Dávidjes		Bryonia africana	5324	Plettenberg Bay—" Back hill."
Doek	(Tondél	Hermas	7108	Mt. summit Krombeks [Riversdale].
Doorn boom	(Karrée doorn—Witte	Acacia racemosa B.	1953	Klaarwater [Griquatown—Hay]
Doorn	(Buffel	Zizyphus bubalinus	1635	Orange River near Prieska.
Doorn	(Drie	Rhigozum trichotomum	1572	Royena Halt [Kuruman].
*Doorn	(Dúbbeltjies	Centopodium B.	1687	Asbestos Mts. [Hay].
Doorn	(Dúbbeltjes	Rumex	6818	Zoetemelk River [Caledon].
*Doorn	(Haak—Monánoe : Mongāna	Acacia detinens	1628	Aakaap Asbestos Mts. [Hay].
Doorn	(Kat	Flacourtia rhamnoides B.	6012	Lower part of Postberg [George].
Doorn	(Pen q.v.			
Doorn	(Plat	Arctopus	6630	Zoetemelk R. [Caledon].
Drie doorn	(vel Korūm bosch	Rhigozum trichotomum	2407/x	Royena Halt and Sand Station [Kuruman].

			Cat. Geog. No.	Locality.
†*Druiven	(Wilde vel Bosch Druiven	Cissus capensis	5504 : 3594	Woods near Knysna Drift ; and at Grahamstown.
Dúbbeltjes	doorn	Centopodium B.	1687	Asbestos Mts. [Hay].
Dúbbeltjes	doorn	Rumex	6818	Zoetemelk River [Caledon].
Eerten	(Wilde	Podalyria an polius Eeweten	5488	Between Melkhout Kraal and Shore [Knysna].
Elzeboom	(Witte	Weinmannia trifolia	5282	In the Forest at van der Wats [Knysna].
*Elze	(Klip Esse : Klip Esche	ord. Rubiaciae	5273	Katjes Kraal [Knysna].
†*Gambrún	(Gamróon	ord. Asclepiadiae	2465	Source of the Kruman R. [Kuruman].
*Gaúna bosch	(Kánna	Salsola	1406	20 miles E. of confluence Ky Gariep [Vaal] and Modder Rs.
*Géelhout	(Witte vel Regte vel Oprecht	Podocarpus	5843	Forest—Sylvan Station [Knysna].
Geelhout	(Auteniqua landsche	Taxus elongata—podocarpus	5293	In the Forest at van der Wats [Knysna].
*Geel Keur		Podalyria v. Cyclopia aurea B.	5519	Witte Elze River [Humansdorp].
Gift Áppel		Cucumis Africanus	960	Berg River [Paarl].
*Gift boom		Cestrum venenatum	5442	Forest near Rex's [Knysna].
Goederen	Hardmájtes	Scirpus tegetalis B.	1387	Bonteberg [Ceres].
*Gommássihout		ord. Ochrosiae	3659	Between Blaauw Krans and Kowi Poort [Bathurst].
Gouds bloem		Arctotis	1517	Tys Kraal [Ceres].
Granáat	bésies	Fusanus ex. ord. Myrti	4260	Near Uitenhage.
Granáat	(Wilde	Gardenia corylana B.	5421[1]	By the Quarry Melkhout Kraal [Knysna].

[1] In Cat. Geog. under this number is Cephaelis Capensis B.

			Cat. Geog. No.	Locality.
*Grass	(Guinea	Sorghum	5465	Rex's Garden [Knysna].
Gras	(Olifents	Aristida ? *vide* Muraltia Depressa B.	6268	Cape St. Blaize.
Guáap		Stapelia pilifera	1299	Roggeve'd.
Guárri		Euclea	4998	At Groote Rivier—Lange Kloof [Uniondale].
Haak doorn	(et Monánoe : Mongãna	Acacia detinens	1628	Aákaap Asbestos Mts. [Hay].
Hardmátjes	Goéderen	Scirpus tegetalis B.	1387	Bonteberg [Ceres].
Harde Peer hout	(Schaapendrolletje	Plectronia ventosa	5469	Below garden at Melkhout Kraal [Knysna].
Harpúis bosch	(Resin	Othonna trifida	1331	Roggeveld.
*Hassagay hout		Curtisia faginea	3601	In woody kloof Grahamstown.
†*Hottentotesche brood		Testudinaria montana B.	2912	Mts. S.W. side of Graaff Reinet.
Hottentotesche touw		Ficus vadicans B.	5412	By the quarry Melkhout Kraal [Knysna].
Hout	(Karrée	Rhus viminale	1682	S.E. Klaarwater Griquatown.
'Inchu 'nChu	*vide* Lekatáni		2211	Litakun [Kuruman].
†*'Ing	(Ofthe Bachapins	Iris	2249/4	Jabiru Fontein [Kuruman].
Kaarsehout	(vulgõ Keershout	Celastrus rostratus	5466	Below garden Melkhout Kraal [Knysna].
Káffer boom		Erythrina Caffra	3701	In wood by spring Blaauw Kranz [Bathurst].
†*Kaffers Koorn		Holcus	5278	Litakun [Kuruman].
*Kalebás	(Wilde	Hibiscus cucurbitinus B.	1481	Dwaal River [Fraserburg].
†Kaméel doorn	(Mokáala	Acacia giraffae	2300	Litakun [Kuruman].
Kaméel doorn		Acacia heteracantha B.	1710	Litakun [Kuruman].
*Kánna bosch	(Gaúna bosch	Salsola	1406	20 miles E. of confluence of Ky Gariep [Vaal] and Modder Rivers.

			Cat. Geog. No.	Locality.
Karrée doorn		Lycium	2119	Graaff Reinet.
†Karrée doorn	(*vide* Doorn boom	Acacia racemosa B.	1953	Buffels Kraal [Laingsburg].
Kat doorn		Flacourtia rhamnoides B.	6012	Lower part of Postberg [George]
†*Kastanje	(Wilde	Calodendron capense	833	Constantia.
†Katjepíring	(Wilde	Gardenia Rothmania	5410	Near quarry Melkhout Kraal [Knysna].
Keúrboom		Virgilia : (Podalyria)	5366	Between Plettenberg Bay and Melkhout Kraal.
Keurboom	(Blaauw	Psoralea pinnata	5492	In corn lands Melkhout Kraal [Knysna].
*Keur	(Gćel	Psoralea aurea B.	5549[2]	Hartbosch near Melkhout Kraal [Knysna].
Keur	(Geel	Podalyria	5519[2]	[Knysna].
Kershout	(rectius Karsehout	Celastrus rostratus	5466	Below garden Melkhout Kraal [Knysna].
Klein Saliehout		Buddleia salviæfolia	5202	Kaatjes Kraal [Knysna].
*Klip Elze	(vulgõ Esse	ord. Rubiaceæ	5755	Between George and Knysna.
Klip hout		ord. Anacardii	7811	Bosjeveld [Genadendal].
Klip Uyentjes et Berg Uyentjes		Antholyza lucidor	7371	Swellendam
†*Klókwe		Macropetalum strictum B.	2498	Pellat Plains [Bechuanaland].
Knoflook	(Wilde	Tulbaghia alliacea	4741	Uitenhage.
Koeman	(Hott.	Ficus capensis	5294	Forest van der Wats [Knysna].
†'Kokogi	(in hyria Hott.	Asclepiadea balanglia-flora B.	2499	Little Klibbolikhonni [Pellat Plains].
Kongkwani		Dais virgata	2222	Pintado Fontein [Pellat Plains].
Korúm		ord. Asclepiadeae	1572	Puff Adder Halt [Philipstown]
Korúm bosch		Rigozum trichotomum	2680	Royena Halt [Kuruman].
*Kraai bésjes		Royena	5490	Melkhout Kraal [Knysna].
*Kréukelboom	(et Lepelboom	ord. Compositae	3387	Zwaartwater Poort [Zuureberg].

[2] In Cat. Geog. notes these numbers are inverted.

			Cat. Geog. No.	Locality.
Kruis bésjes		Grewia occidentalis	5445	Knysna Forest.
Kruis doorn	(et Schaap-drolletjes	ord. Rubiaceae	7218	Grootevaders Bosch [Swellendam].
†*Kúkumakránki		Gethyllis ciliaris	7209	Cape Flats.
†Kussenátjes	(Coesinatjes	Crassula colonnaris	1402/3	Karree River [Worcester].
Langéer		Polygale myrtifolia	5228	Edge of Forest Kaatjes Kraal [Knysna].
Lekatáni		Cucumis	2207	Litakun [Kuruman].
Lekatáni		lefèeii	2208	Litakun [Kuruman].
Lekatáni		Năhănă	2209	Litakun [Kuruman].
Lekatãni		kuóii	2210	Litakun [Kuruman].
Lekatãni	vel 'Inchu	'nchŭ	2211	Litakun [Kuruman].
Lemóen	(Wilde	Capparis citrifolia	5393	Melkhout Kraal [Knysna].
Lépelboom		conf. Arnica ?	3387	Zwaartwater Poort [Zuureberg].
*Leshũam		Amaryllis toxicaria	2247/3	Pellat Plains Bechuanaland.
*Lichús		Baviana hypogoea B.	2241	Pellat Plains Bechuanaland.
†*Likkokwáan		Drimia	2247/4	Pellat Plains Bechuanaland.
Lindenboom		Morus	5283	In Forest at van der Wats [Knysna].
†*Linga		Dolichos catiang	2213	Litakun [Kuruman].
*Litamani	(Tãma et Tamani	Bauhinia esculente	2414	Patani Bechuanaland.
†*Litúing		Gladiolus edulis	2240	[Pellat Plains]
†*Mábbole	(Kaffers Koorn	Holcus caffrorum	2214	Litakun [Kuruman].
Mátjes—goédered		Cyperus textilus	4055	Riet Fontein—S.E. towards sea at Kowie [Bathurst].
Melkboom	(Melkhout	Sideroxylum inerme	4409	Uitenhage.
Mélkboom		Euphorbia antiquorum	3408/x	Zwaartwater Poort [Somerset East].
Mélk Touw	vel Melk Baviaans Touw	ord. Cynanchi	5396	Knysna.

			Cat. Geog. No.	Locality.
*Mest vy bloem		Brunsvigia	2703/3	Horse's Grave [Colesberg].
Métsi sanni		Acacia elephantina B.	2245	Pintado Fontein [Pellat Plain].
†Mohâaka		Tarchonanthus Litakunenens B.	2202	Litakun [Kuruman].
†*Mókwi	(vel Mukwi	Acacia robusta B.	2265	Litakun [Kuruman].
†Molókha		Croton gratissimus B.	2493/2	Little Klibbolikhonni [Kuruman].
Monána	(vel Haakdoorn (Mongãna	Acacia detinens B.	2266	
†*Mori		Triaspis hypericoides B.	2593	Kosi Fontein: ruins of old Litakun [Kuruman].
Móri	(an Móri merè florem quem libet designare sotius			
*Msóhu		Acacia Lit. B.	2205	Litakun [Kuruman].
Muisbosch		Galenia africana	6414	E. side of Gourits River [Riversdale].
Niezhout	(Tkóo vel Stinkhout	conf. ord. Malpighiarum	4801	Between Melkhout and Camtos R. [Humansdorp].
*Nieshout		ord. Terebinthaceae	3170	Boschberg [Somerset East].
Nũmnũm		Arduina bispinosa	2920	Mts. S.W. side of Graaff Reinet.
Olifants Gras		Aristida ?	6268	Cape St. Blaize.
Olyven	(Wilde	Cratoera apetala	4415	Between Uitenhage and Chalybeate Spring.
Oomsboom		Fagara	4168	Lombards and Hassagay Bosch [Bathurst].
Oprécht Geelhout	(et Witte Geelhout	Podocarpus	5843	Forest—Sylvan Station [Knysna].
Paardepis		Boscia undulata	5489	Between Melkhout Kraal and Shore [Knysna].
Palmíet		Juncus serratus	6528	Groote Valsche Rivier Lat. 34°, Long. 22°.

			Cat. Geog. No.	Locality.
Pampoén	(Wilde Ramanas	Gunnera perpensa	3942	Rietfontein [Bathurst].
Péeho	(Wilde dakka	Leonitis globosa	2233	[Pellat Plains Bechuanaland].
*Peer	(Witte	Laurus	4248	Near Uitenhage.
Peer hout	(Harde	Plectronia ventosa	5469	Melkhout Kraal [Knysna].
*Pen doorn		Celastrus linearis B.	2872	Snow Mts. Graaff Reinet.
Péper	(Bosch et Wilde	Piper Capense	5397	By the Quarry Melkhout Kraal [Knysna].
Písgoed		Euphorbia	3841	Between Kowi and Date Tree [Bathurst].
Platdoorn		Arctopus	6630	Zoetemelk R. [Caledon].
†Pruim	(Wilde	ord. Sapindaceae	4422	Uitenhage.
Ranke Vyg		Ficus (pisifora B.)	5238/x	Kaatjes Kraal [Knysna].
†*Rhinóceros bosch	(vulgo Renosterbosch	Stoebe Rhinocerotis	1025	Babylonsche Toren [Caledon].
Riet		Arundo barbata B.	1636	Kosi Fontein [Kuruman].
Riet	(Berg	Restio	7026	Near Mt. [Swellendam].
†*Roodeblad		Termanalia erythrophylla B.	1749	Hippo Station Vaal River.
Roodehout		Ochna dicorticata B.	5447	Forest at Melkhout Kraal [Knysna].
Rot staart		Antholyza ringens	8563	Towards the Steenbergen from Constantia.
Sálie	(Wilde	Salvia Aethiopis	1801	Groote Fontein [Hay].
Sáliè hout		Tarchonanthus	5336	Hills near Plettenberg Bay.
Salie hout	(Klein	Buddleia salvifolia	5202	Forest: Kaatjes Kraal [Knysna].
*Saffraán hout		Ilex crocea et Hartogia Capensis	5271	Kaatjes Kraal [Knysna].
Saffráan hout		Elæodendron	4661	Stade's Rivier [Port Elizabeth].
Saffráan hout		Olea serrulata	5572	Juffrouw Voslos [George].
Schaapdrólletjes	(et Wolfdoorn	ord. Rubiaceae	7218	Grootevaders Bosch [Swellendam].

			Cat. Geog. No.	Locality.
See bast *vide* Zydebast		Eldodendron	7225	Grootevaders Bosch [Swellendam).
†Shambreuil boom	(et Zeven blads boom	Cussonia montana B.	2700	Horse's Grave [Colesberg].
*Siki		Acacia stolonifera B.	2138	Klibbolikhonni Font. [Kuruman].
†*Singápe	(Grapple plant	Uncaria procumbens B.	1970	Litakun [Kuruman].
Slang bosjes		Stoebe	5461	S. of Melkhout Kraal [Knysna].
Smal blad		Metrosideros augustifolia	7524	Storm Valley ; Zonder einde R. [Swellendam].
Spek boom		Portulaccaria afra	4283	Between Algoa Bay and Uitenhage.
Staart	(Rot	Antholyza ringens	8563	Witteboom near Constantia.
Stink bosch		Tenaria arborescens	2778	Naauwe Poort.
*Stink hout	(Witte	Celtis	3146	Boschberg [Somerset East].
Stink hout	(Witte	Kiggellaria	7243	Buffeljaagt's R. [E. of Swellendam].
*Stink hout	(Witte et Zwart	Laurus bullata B.	5236	Melkhout Kraal [Knysna].
Stink hout	(v. Niezhout	ord. Terebinthaceae	3170	Boschberg [Somerset East].
Taaibosch		Rhus laevigata	1722	Prieska and Hay.
Táma et Támani	(Litámani	Bauhinia esculente B.	2414	Patani [Bechuanaland].
Tchatachy	(et Bastard anyswortel	Thalictroides	1728	Klaarwater [Griquatown Hay].
†*Tchy	(vel Tký	Ceropigia	2499	Little Klibbolikhonni Fontein [Kuruman].
Tellerium		Morea	2252	Source of Moshowa [Kuruman].
Tetúli		Drimia	2272/x	Between Litakun and old Litakun [Kuruman].
Thée	(Boschjesmans	Weinmannia	5520	" Houtbosch " [Knysna].
*Tkoo	(v. Niezhout	ord. Terebinthaceae	3170	Between Melkhout and Camtos R. [Humansdorp].
Tokwi	(resembling	Aloe saponaris	2198	Litakun [Kuruman].

			Cat. Geog. No.	*Locality.*
Tondel doek		Hermas	7108	Summit Mt. Station [Swellendam].
Touw	(Baviaans	Cissus	5396	Melkhout Kraal [Knysna].
Touw	(Hottentotsche	Ficus radicans B.	5412	By the quarry Melkhout Kraal [Knysna].
Tulp		Morea collina	5552	Melkhout Kraal [Knysna].
Tulp		Iris	6005	Sylvan Station [George].
*Váderlandsche Wilganhout		Terminalia	4165	Hassagay Bosch [Bathurst].
*Vlierboom	(Wittehout—wilde	Chilianthus B.	5295	Forest at van der Wats [Knysna].
Vyg	(Adams	Ficus	5441	Rex's Garden [Knysna].
Vyg	(Ranke	Ficus pisifora B.	5238/x	Kaatjes Kraal [Knysna].
Vyg	(Wilde	Ficus Capensis	3676	Blaauw Krans [Border of Albany and Bathurst].
Úyen	(Wilde	Allium	6626	Zoetemelk R. E. of Genadendal.
Uýentjes	(Water	Aponogeton distachyon	4883	Lange Kloof [Uniondale].
Wágenboom		Protea grandiflora	4885	N. side of Tsitsikama [Uniondale].
*Wagt een beetje		Zizyphus	3195	Boschberg [Somerset East].
Water melóen	(Bitter	Cucumis scoloquintida	2128	Litakun [Kuruman].
Wilde Absyńth	(rectus alsem	Eriocephalus	1171	Karro Poort [Ceres].
Wilde Álsem		Artemisia Afra	1553	[Carnarvon].
Wilde Aprikóos		ord. Eugeniae ?	4061	Riet Fontein near Mossel Bay.
Wilde Druiven		Cissus capensis	5504	Woods near Knysna Drift.
Wilde Kalebás		Hibiscus cucurbitinus B.	1481	Litakun [Kuruman].
†*Wilde Kastánje		Calodendron capense	833	Constantia.
Wilde Olyven		Cratoera apetala	4415	Between Uitenhage and Chalybeate Spring.
Wilde Pampóen		Gunnera perpensa	3942	Rietfontein [Bathurst].
Wilde Pruim		ord. Sapindaceae	4422	Uitenhage

			Cat. Geog. No.	*Locality.*
Wilde Sálie		Salvia Aethiopis	1801	Groote Fontein [Hay].
Wilde Vlierboom		(Scoparia) Chilianthus	5240	Karreebergen [Carnarvon].
Wilde Ityen		Allium	1547	Schiet Fontein.
Wilgan hout	(Vaderlandsche	Terminalia	4165	Hassagay Bosch [Bathurst].
Wilgan boom		Salix Gariepena	1637	Orange River Prieska.
Witgat boom		Capparis coriacea B.	2898	Mt. S.W. of Graaff Reinet.
Witte doorn	(Doornboom	Acacia racemosa B.	1953	Klaarwater [Griquatown Hay].
Witte Elze		Weinmannia trifolia	5282	In forest at van der Wats [Knysna].
Witte Geelhout		Podocarpus	5223	Kaatjes Kraal [Knysna].
*Witte bosch	(hout	Scleroxylon Jacquini	5286	Forest [Knysna].
Witte hout		Prinos	5403	Melkhout Kraal [Knysna].
Witte Peer		Laurus	5221	Kaatjes Kraal [Knysna].
Witte Stinkhout		Celtis	3146	Boschberg [Somerset East].
Witte Yzerhout		Ochna	4238	Between George and Knysna.
*Wolf doorn	(et Schaapdrólletjes	ord. Rubiaceae	7218	Grootevaders Bosch [Swellendam].
Wortel	(anys	Seseli	1286	Roggeveld [Sutherland].
*Yzerhout		Olea undulata B.	6013	Lower part of Postberg [George].
*Yzerhout	(Witte	Boscia undulata	4670	van Stad's River [Uitenhage].
Yzerhout	(Zwart	Olea	5272	Kaatjes Kraal [Knysna].
Zeebast	(*vide* Zydebast	Elæodendron	7225	Grootevaders Bosch [Swellendam].
Zevenbladsboom	(Shambreuilboom	Cussonia montana B.	2700	Horse's Grave [Colesberg].
*Zwart bast		Royena lucida	3062/2	Bruyntje's Hoogte Berg [Somerset East].
Zwart bast		Royena deeidua B.	1750	Orange River, Prieska.
Zwart bast		Euonymus ?	5255	Kaatjes Kraal [Knysna].
Zydebast	(vulgo Seebast	Hartogia capensis	5258	Kaatje's Kraal [Knysna].

PLATE 40. *Cladendron capense* (Wilde Kastanje). From a drawing by William J. Burchell, at Constantia 18 February, 1811. The original drawing is delicately tinted.

NOTES ON THE FLORA OF RHODESIAN MANICALAND: I.

(With Plates 41—45.)

By H. B. Gilliland.

It is intended to publish a series of "Notes" on the Flora of Rhodesian Manicaland (*Gilliland*, 1938*a*) supplementing the account of the vegetation already given (*Gilliland*, 1938*c*). Only those species which are not hitherto recorded in the literature as from Manicaland will be noted. The field notes given refer to vegetation types dealt with in the paper referred to above.

Speaking generally, two types of geographical relationship are shown. Relationship with the north and with the south—a general "East African" relationship—which is particularly marked in the flora of the upper or mountain zone; and a relationship with the west—with Angola, round the edge of the Congo Basin, to Nigeria—which is shown chiefly by some species from the lower muPfuti zone.

The upper mountain zone is unique in Rhodesia except for portions of Umtali county and Gazaland (*Swynnerton*, 1911) and occasional records from the Umvukwe Hills (*Gilliland*, 1938*b*).

I have very gratefully to acknowledge financial assistance in pursuing these investigations from the Beit Railway Trustees, the Carnegie Research Grant Board and the University of the Witwatersrand.

BRYOPHYTA.

By W. R. Sherrin and H. B. Gilliland.

Records of the Bryophytes from Rhodesia are scarce, Eyles' (1916) list records some dozen and Sim (1926) notes many localities, but very few have as yet been recorded from Manicaland.

I. HEPATICAE.

(*a*) Marchantiaceae.

1. **Marchantia tabularis** *Nees, Hep. Eur. iv.* 71; *Sim, Trans. Roy Soc. S.-A. xv.* (1926) 28.

Mountain zone: Farm lands: Along the wall of an irrigation furrow: Nodzi; May, 1934, No. 217.

2. **Fimbriaria marginata** *Nees, in Hort. Phys. Berol.* (1820), 44 ; *Sim, in S.-A. Jour. Sci.* (1922) 297.

Mountain zone : Gum plantation : In mats facing south-west : Nodzi : May, 1937. No. 215.

(*b*) Blyttiaceae.

3. **Symphyogyna Lehmanniana** *Mont. and Nees, Syn. Hep.* 483 ; *Sim, Trans. Roy. Soc. S.-A.* (1926) 33.

Mountain zone : Indigenous forest : Forming a very large bed on a bank in deep shade : Mt. Nuza ; June 1934, No. 306. Growing at the foot of a *Cyathea* in the shade of the canopy near water ; Mt. Nuza ; June 1934. No. 361.

(*c*) Lophoziaceae.

4. **Plagiochila crispulo-caudata** *Gottsche, Abh. Nat. Ver. Bremen. vii*, 249. *Sim, l.c.* (1922) 298 ; *l.c.* (1926) 110.

Mountain zone ; Indigenous forest : Common in festoons hanging round the base of trees and shrubs in deep shade : Mt. Nuza ; June, 1934. No. 359.

5. **P. natalensis** *Pears. Christ. Ved. Sels. Gornh.* (1886), 15 ; *Sim, l.c.* (1926) 109.

Mountain zone : Indigenous forest : Covering a boulder in the fringing forest of the stream ; mixed with but in deeper shade than *Trachypodopsis serrulata* ; Nyumkombe Valley ; August, 1934. No. 742.

II. MUSCI.

(*a*) Sphagnaceae.

6. **Sphagnum angolense** *Warnst. in Bull. Herb. Boiss.* (1901), 1086.

Mountain zone : Vlei community in grassland : Growing in damp hollows between grass clumps ; 5,600 ft. on Mt. Nuza plateau : June, 1934. No. 509.

7. **Sphagnum ericetorum** *Brid. Bryol. Univ.* (1826) *apud Warnst. die Torfm. in Konigl. Bot. Mus. in Berlin im Bot. Centralbl.* (1882) *n.* 3—5 *et in Hedwigia xxix* (1890) 227 ; *Taf. viii, f.* 28, 29 ; *Taf. x. fig.* 1, 12.

Mountain zone : Riverine community : Falling in cascades over a ledge of rock on the banks of the Nyumkombe River, October, 1934. No. 893.

(*b*) Polytrichaceae.

8. **Pogonatum capense** (*Hampe*) *Jaeg. Adumbr. i.* 711 ; *Dixon in S.-A. Jour. Sci.* (1922), 323 ; *Sim, l.c.* (1926) 136.

Mountain forest : Disturbed areas : Growing erect and separately but in large beds on a face of clay ; Mt. Nuza ; June, 1934. Nos. 247 and 248.

9. **Polytrichum Hohnelii** *C.M. in Flora* (1890), 471 ; *Sim, l.c.* 140 *in notis sub. P. commune.*

Mountain zone : Indigenous forest : Growing on a red clay slope in kloof forest ; Mt. Nuza ; June, 1934.

(*c*) Fissidentaceae.

10. **Fissidens glaucescens** *Horns. in Linnaea* (1841), 154 ; *Sim, l.c.* 201.

Mountain zone : Gum plantation : Growing in mats on a bank facing south-west : Nodzi ; May, 1934. No. 214.

11. **Fissidens submarginatus** *Bruch. in Flora* (1846), 133 ; *Dixon, l.c.* 306 ; *Sim, l.c.* 193.

Mountain zone : Indigenous forest ; On a small face of red clay-loam in fringing forest : Mt. Nuza ; June, 1934.

(*d*) Trichostomeae.

12. **Leptodontium squarrosum** (*Hook*) *Par. Ind.* ; *Sim, l.c.* 249.

Mountain zone : Rocks : Covering the south and west faces of a boulder at 6,600 ft. on the ridge of Mt. Nuza ; June, 1934. No. 423.

(*e*) Orthotrichaceae.

13. **Macromitrium tenue** (*Hk. and Grev.*) *Brid. Bryol. Univ. i.* 740 ; *Sim, l.c.* 280.

Mountain zone : Churu : Growing on the bark of *Rapanea melanophleos* in a black vlei churu at 5,600 ft. on Mt. Nuza plateau ; July, 1934. No. 552.

(*f*) Bryaceae.

14. **Bryum truncorum** *Bory in Brid. Bryol. Univ. i.* 699 ; *Dixon, l.c.* 321 ; *Sim, l.c.* 337.

Mountain zone : Grassland : Rocks : On a tiny shoulder of granite ; 5,600 ft. on Mt. Nuza plateau ; July, 1934. No. 530.

15. **Bryum capillare** *Linn. Suppl.* (1756) 30 ; *Sim, l.c.* 335.

Mountain zone : Disturbed areas ; Growing on a red clay slope in shade of overhanging bushes in kloof forest ; Mt. Nuza, 5,800 ft. ; June, 1934. No. 353.

16. **Rhodobryum umbraculum** (*Bruch.*) *Par. Ind. ed. ii.* (1906), 202 ; *Sim, l.c.* 339.

Mountain zone : Indigenous forest : Growing in a bed on the floor of kloof forest : Mt. Nuza ; August, 1934. No. 737.

17. **Rhodobryum Commersonii** (*Schwaeg.*) *Par. l.c.* 198 ; *Dixon, l.c.* 321 ; *Sim, l.c.* 340.

Mountain zone : Indigenous forest : In shelter cast by some fallen leaves of *Cyathea* on the floor at the edge of kloof forest : Mt. Nuza ; June, 1934. No. 364.

(*g*) Hedwigiaceae.

18. **Hedwigidium imberbe** (*Sm.*) *Steph. Bry. Eur. iii. Mon. p.* 3. *t.*1. ; *Sim, l.c.* 349.

Mountain zone : Grassland : Rocks : Covering the north and east faces of a boulder at 6,600 ft. on Mt. Nuza ; June, 1934. No. 424.

(*h*) Leucodontaceae.

19. **Leucodon assimilis** (*C.M.*) *Jaeg. Ad. ii.* (1877-78) 124 ; *Sim, l.c.* 358.

Mountain zone : Indigenous forest : On riverside ledges and boulders in the Nyumkombe Valley forest ; October, 1934. No. 879.

muPfuti zone : Riverine : Growing on boulders near the Honde Falls ; November 1934. No. 1099.

(*i*) Brachytheciaceae.

20. **Brachythecium pseudoplumosum** *Brid. Mant. M.*, 170 ; *Sim, l.c.* 371.

Mountain zone : Gum plantation : Growing in mats on a bank facing south-west : Nodzi ; May, 1934. No. 214.

Grassland : Rocks : On the west face of a granite outcrop : Farm Charity ; June, 1934. No. 531.

(*j*) Neckeraceae.

21. **Aerobryopsis capensis** (*C.M.*) *Fleisch. in Hedw.* (1905) ; 305 *Sim, l.c.* 394.

Mountain zone : Indigenous forest : Hanging in festoons from branches in chiNyamariro forest, but rare ; August, 1934. No. 748.

22. **Pilotrichella chrysoneura** (*Hampe*) *Jaeg. Adumbr. ii.* (1877-78), 100 ; *Sim, l.c.* 397.

Mountain zone : Indigenous forest : Hanging in festoons from the branches in chiNyamariro forest, common ; August, 1934. No. 749.

23. **Porothamnium natalense** (*C.M.*) *Lindb. in Hedw. xli.* (1902), 209 ; *Sim, l.c.* 403.

Mountain zone : Indigenous forest : Growing thickly on the bark of trees in the chiNyamiriro forest ; August, 1934. No. 750.

(*k*) Entodontaceae.

24. **Trachyphyllum gastrodes** (*Welw. and Duby*) *Gepp. Dixon, l.c.* 326 ; *Sim, l.c.* 405.

Mountain zone : Indigenous forest : Growing on riverside ledges and boulders in the Nyumkombe forest ; October, 1934. No. 879.

25. **Entodon Dregeanus** (*Hornsch.*) *C.M. in Linnaea* (1844), 706 ; *Dixon, l.c.* 326 ; *Sim, l.c.* 411.

Mountain zone : Indigenous forest : Common moss in kloof forest on the south face of Mt. Nuza ; September, 1934. No. 829.

26. **Entodon natalensis** *C.M. in Hedw.* (1899), 133 ; *Sim, l.c.* 410.

Mountain zone : Churu : Growing all over the slanting stems of a shrubby *Solanum* in a *Solanum-Hypericum* churu : Mt. Nuza plateau ; June, 1934. No. 497.

(*l*) Hypnaceae.

27. **Ectropothecium regulare** (*Brid.*) *Jaeg. Adumbr. ii.* 531 ; *Dixon, l.c.* 330 ; *Sim, l.c.* 425.

muTsatsa zone : muTsatsa-muJanje community : Growing under a boulder but getting the afternoon sun ; Odzani valley ; August, 1934. No. 716.

(*m*) Sematophyllaceae.

28. **Sematophyllum brachycarpum** (*Hampe*) *Broth. Die. Nat. Pflanzenfam. Musci, ed. ii.* (1924), 431 ; *Sim, l.c.* 435. *Rhapidostegium brachycarpum* (*Hampe*) *Jaeg.* ; *Dixon, l.c.* 331.

Mountain zone : Disturbed areas : Covering the faces of a boulder above the *Marchantia-Fimbriaria* belt on an irrigation furrow at Nodzi : May, 1934. No. 218.

(*n*) Hookeriaceae.

29. **Cyclodictyon vallis-gratiae** (*Hampe*) *Broth. l.c. ed. i.* 395 ; *Sim, l.c.* 443.

Mountain zone : Indigenous forest : On a rock in a stream bed of running water under full canopy of kloof forest : Mt. Nuza ; June, 1934. No. 362.

(*o*) Rhacopilaceae.

30. **Rhacopilum capense** *C.M. in Hedw.* (1899), 124 ; *Dixon, l.c.* 328 ; *Sim, l.c.* 447.

Mountain zone : Indigenous forest : Forming a dense mat growing over a tree in kloof forest : Mt. Nuza ; June, 1934. No. 301.

PTERIDOPHYTA.

By A. H. G. Alston and H. B. Gilliland.

Ferns and their Allies are distributed in Rhodesian Manicaland in a manner closely correlated with the three main vegetation types. Thus the great majority occur in the upper or mountain zone, while

the types recorded from the lower muTsatsa and muFuti zones are usually quite distinct species. This is, to a large extent, correlated with temperature and rainfall; the climates of the lower two zones being sub-tropical and tropical respectively, while the climate of the mountain zone—equivalent to the "mist-belt" of the Union of South Africa—is more temperate.

In the collections made from this area not a few species (asterisked in the enumeration) have emerged as new records for Africa south of the Zambesi. Amongst these *Cyathea Deckenii* stands out as the most striking. Photographs (plate 42) illustrate this interesting plant.

Specimens are represented in the herbarium of the Witwatersrand University and in the British Museum Herbarium.

The great majority of the ferns, if given a name at all, are referred to by the Manyika as "*Nyagatsenja*" but there are some few exceptions to this rule; thus bracken is called "*ruGombwe*".

I. FILICALES.

(*a*) Hymenophyllaceae.

1. ***Hymenophyllum Kuhnii** C. Chr. Ind. Fil. (1905) 363.

   Mountain zone: Kloof forest in the Nyumkombe valley: Growing along the horizontal branch of a tree; August, 1934. No. 736.

(*b*) Cyatheaceae.

2. ***Cyathea Deckenii** Kuhn in v. Deck. Reis. iii. pt. 3 (1859) 57.

   Mountain zone: Ziwani Forest: Giant tree fern of 15—30 ft. along the stream bed. Stem, rarely 5 ins. in diameter, covered with spiny leaf bases. Up to 8 ft. high on the stem project prop-roots which buttress the base heavily to a height of 6 ins. March 1935. No. 1750. "*Nyagatsenja.*" Widespread in E. Africa and possibly conspecific with the W. African *C. Manniana Hook.*

(*c*) Polypodiaceae.

3. **Dryopteris africana** (Desv.) C. Chr. Ind. Fil. (1905) 251.

   Mountain zone: Kloof forest on Mt. Nuza: Rosette fern growing in dense shade: Fronds 1½—3 ft. long; June, 1934. No. 293.

4. **Dryopteris athamantica** (Kze) O. Kuntze, Rev. Gen. Pl. ii. (1891) 812; Sim, Ferns of South Africa, ed. ii. (1915) 107: Burtt Davy, Man. Fl. Plts. Transvaal, i. (1926) 75.

   Nephrodium athamanticum (*Kze*) *Hook., Sim, l.c. ed. i.* (1892) 183; *Gepp, Jour. Linn. Soc. xl.* (1911) 241: *Eyles, Trans. Roy. Soc. S.-Afr. v.* (1916) 279.

muFuti : Riverine vlei community : Fern growing at 3,500 ft. in the iNyumquarara Valley. February, 1935. "*Nyagatsenja.*"

5. **Dryopteris prolixa** (Willd.) O. Ktze. Rev. Gen. ii. (1891) 813, var. **Bergiana** (Schl.) Alston, comb. nov !

D. Bergiana (*Schl.*) *O. Ktze*, *Sim*, *l.c. ed. ii* 93 ; *Burtt Davy*, *l.c.* 79. *Nephrodium Bergianum* (*Schl.*) *Baker*, *Sim*, *l.c. ed. i.* 175 ; *Eyles*, *l.c.* 280 and 288. *Polypodium obtusilobum Eyles non Desv. l.c.* 288.

Penhalonga : Bennett and Holland.

muFuti : Fern of a stream bank amongst Narwatsi : Honde Valley. November, 1934. No. 1124.

6. **Didymochlaena truncatula** (Sw.) J. Sm. Jour. Bot. 4 (1841) 196 ; Sim, ed. ii. 112 ; Burtt Davy, l.c. 80.

D. lunulata Desv. Sim, *l.c. ed. i.* 164 ; *Gepp*, *l.c.* 240 ; *Eyles*, *l.c.* 286. *D. sinuosa Desv*, *Eyles*, *l.c. in syn.*

Mountain zone : Ziwani forest : Stout fern with fronds of 3—6 ft. Stem short and stout. March, 1935. No. 1747.

7. ***Nephrolepis undulata** (Afz.) J. Sm. in Bot. Mag. lxxii Comp. (1846) 35.

muFuti : Riverine community : Stream bed fern at 3,500 ft. in the iNyumquarara Valley. February, 1935. No. 1644. "*Nyagatsenja.*"

Commonly referred to *N. cordifolia* (*L.*) *Presl.*, which has scaly rachises and more coriaceous pinnules.

8. ***Asplenium hypomelas** Kuhn Fil. Afr. (1868) 104.

Mountain zone : Kloof forest of the Nyumkombe valley : common epiphyte : September, 1934. No. 759. Rosette fern growing in dense shade ; fronds 4—6½ ft. long. Mt. Nuza kloof forest. June, 1934. No. 294.

9. ***Asplenium linearilobum** Peter in Fedde Rep. Beih. xl. (1929) 80, t 2, f. 7—8.

Mountain zone : Kloof forest of the Nyumkombe Valley : an epiphyte. September, 1934. No. 754.

10. **Asplenium Mannii** Hook. Second. Cent. Ferns, (1861) t. 60 ; Gepp, l.c. 240 ; Eyles, l.c. 283 ; Sim, l.c. ed. ii. 174.

Mountain zone : Kloof forest in Nyumkombe Valley : Common epiphyte. September, 1934. No. 751.

11. **Asplenium aethiopicum** (Burm) Becherer in Candollea vi. (1935) 23.

A. praemorsum Sw. Prodr. (1788) 130 ; *Sim*, *l.c. ed. ii.* 163. *A. furcatum Thunb. Sim*, *l.c. ed. i.* 282 ; *Gepp*, *l.c.* 239 ; *Eyles*, *l.c.* 282. *A. adiantoides Eyles non C. Chr. l.c.* 282 *in syn.*

Mountain zone : Hypericum churu in grassland : In crevices of a boulder at 5,600 ft. on Mt. Nuza. Fronds 6—15 ins. long. June, 1934. No. 529.

12. **Asplenium Sandersoni** Hook. Sp. Fil. 3 (1860) 147 t. 179 ; Sim, ed. i. 132 ; ed. ii. 139 ; Eyles, l.c. 283 ; Burtt Davy, l.c. 83.

    Mountain zone : Kloof forest in the Nyumkombe Valley ; common epiphyte. September, 1934. No. 752.

13. **Blechnum capense** (Linn.) Schl. Adumbr. (1825) 34, t 18 ; Sim, l.c. ed. ii. 186 ; Burtt Davy, l.c. 85.

    Lomaria procera Spreng. Sim, l.c. ed. i. 122 ; *Gepp, l.c.* 239 ; *Eyles, l.c.* 281.

    Mountain zone : Vlei edge community : On the stem of a *Cyathea* : fronds 6—18 ins. Mt. Nuza plateau. July, 1934. No. 498.

14. **Blechnum tabulare** (Thunb.) Kuhn, Fil. Afr. (1868) 94 ; Sim, l.c. ed. ii. 188 ; Burtt Davy l.c. 85.

    Lomaria Boryana Willd. Gepp. l.c. 239 ; *Eyles, l.c.* 281.

    Mountain zone : Kloof forest on Mt. Nuza : semi arboreal fern with stem 2 ft. high and 2 ft. in circumference. Individual fronds $3\frac{1}{2}$-$4\frac{1}{2}$ ft. Under canopy. June, 1934. No. 266.

15. **Pellaea calomelanos** Link. Fil. Sp. (1841) 61 ; Sim, ed. i. 104 ; Gepp. l.c. 238 ; Eyles, l.c. 284, p.p.

    P. hastata (Thunb.) Link. Fil. Spec. (1841) 60.

    muTsatsa : Xerosere : Growing on a granite koppie beside the Inyanga road ; Oct., 1934. No. 1023.

16. **Pellaea Doniana** (J. Sm.) Hook. Sp. Fil. ii. (1858) 137 ; Sim, Trans. S.-Afr. Phil. Soc. xvi. (1907) 279 ; Ferns of S.-Afr. ed. ii. 211 ; S.-Afr. Jour. Sci. (1923) 311 ; Eyles, l.c. 284.

    Mountain zone : Kloof forest at 4,500 ft. in Nyumkombe valley ; Feb., 1935. No. 1570.

17. **Pellaea viridis** (Forsk.) Prantl. in Engl. Jahrb. iii. (1882) 420 ; Sim, l.c. ed. ii 227 ; Burtt Davy, l.c. 86.

    P. hastata Link. non Prantl. ; Sim, l.c. ed. i. 101 *; Gepp, l.c.* 238 *; Eyles, l.c.* 285.

    muFuti : Riverine rocks : At 3,500 ft. in the iNyumquarara valley ; Feb., 1934. No. 1677.

18. **Notholaena Buchanani** Baker, Syn. Fil. (1868) 373 ; Sim, ed. ii. 222 ; Burtt Davy, l.c. 88.

    Notochlaena Eyles, l.c. 285.

    muFuti : Xerosere : Growing in crevices of a rock mass at 3,000 ft. in the iNyumquarara valley ; Feb., 1935. No. 1568.

19. **Cheilanthes multifida** Swartz, Syn. 129 (1806) 334 ; Sim, ed. i. 87 ; ed. ii. 228 ; Eyles, l.c. 285 ; Burtt Davy, l.c. 88.
Mountain zone : Grassland : Growing in the shelter of the north and west faces of a boulder at 6,200 ft. on Mt. Nuza ; June, 1934. No. 399.

20. **Adiantum cuneatum** Langsd. et Fisch. Ic. Fil. (1810) 23 t. 26.
muTsatsa : Riverine on farm : On a steep stream bank ; Nodzi ; Sept., 1934. No. 802.

21. **Vittaria isoetifolia** Bory, Voyage, ii. (1804) 325 ; Gepp, l.c. 242 ; Eyles, l.c. 284 ; Sim, l.c. ed. ii. 267.
V. lineata of Sim, l.c. ed. i. 216 *; Eyles, l.c. in syn.*
Mountain zone : chiNyamariro forest : On a tree trunk ; March, 1935. No. 1628.

22. **Loxogramme lanceolata** (Sw.) Presl. Tent. (1836) 215, t. 968.
Polypodium loxogramme Mett. Sim, l.c. ed. ii. 281 ; *Burtt Davy, l.c.* 91. *Gymnogramme lanceolata Hook ; Sim, l.c. ed. i.* 215 *; Gepp, l.c.* 242 *; Eyles, l.c.* 284.
Mountain zone : Kloof forest in the Nyumkombe valley ; common epiphyte ; Aug., 1934. No. 759.

23. **Elaphoglossum Aubertii** (Desv.) Moore, Index. Fil. (1857) 5 ; Sim, l.c. ed. ii. 289.
Mountain zone : Kloof forest in the Nyumkombe valley : In bunches on the banks of the stream ; Aug., 1934. No. 739.

24. ***Elaphoglossum isabelense** Brause in Engl. Jahrb. liii. (1915) 431.
Mountain zone : Kloof forest in the Nyumkombe valley : Fern with deep green leaves growing on the river banks in heavy shade ; Sept., 1934. No. 890.

(*d*) Gleicheniaceae.

25. **Gleichenia polypodioides** (Linn.) Smith, Mem. Ac. Turin. 5 (1793) 419 ; Sim, l.c. ed. i. 43, ed. ii. 297 ; Gepp, l.c. 237 ; Eyles, l.c. 289 ; Burtt Davy, l.c. 92.
Mountain zone : Kloof forest of the Nyumkombe valley : Quite common ; Aug., 1934. No. 907.

26. **Gleichenia umbraculifera** (Kze.) Moore, Ind. Fil. (1862) 384 ; Sim, l.c. ed. i. 44 ; ed. ii. 298 ; Gepp, l.c. 237 ; Eyles, l.c. 289 ; Burtt Davy, l.c. 92.
Mountain zone : Kloof forest on Mt. Nuza : Much branched fern in a grove in deep shade ; June, 1934. No. 305.

(*e*) Schizeaceae.

27. **Aneimia Schimperiana** Presl. Suppl. (1845) 84. sens. lat.
A. anthriscifolia of Sim, Trans. S.-Afr. Phil. Soc. xvi. (1907)

294 ; *Eyles, l.c.* 289 ; *Sim, l.c. ed. ii.* 308 ; *Burtt Davy, l.c.* 93 *non Schrad.*

muFuti : In muFuti : On a rocky streambank in the iNyumquarara valley ; Feb., 1935. No. 1646. "*Nyagatsenja.*"

A. anthriscifolia Schrad. is confined to S. America.

II. LYCOPODIALES.

(*a*) Lycopodiaceae.

28. **Lycopodium clavatum** Linn. var **inflexum** (Beauv.) Spring. in Mem. Ac. Sci. Brux. xv. (1842) 90 ; Gepp, l.c. 244 ; Eyles, l.c. 291 ; Burtt Davy, l.c. 96.

L. clavatum Sim non Linn. l.c. ed. i. 245 ; *ed. ii.* 329.

Mountain zone : Kloof forest on Mt. Nuza : Forming a dense mat twining over the ground amongst the stems of other plants in the shade over the bed of a stream. Frequently fasciated ; June, 1934. No. 279.

29. **Lycopodium sarcocaulon** A. Br. ; Welw. ex Kuhn Fil. Afr. (1868) 210.

L. carolinianum var. grandifolium Spring. in Mem. Ac. Sci. Brux. xxiv. (1850) 46 ; *Burtt Davy, l.c.* 96. *L. carolinianum Sim non Linn. l.c. ed. i.* 246 ; *ed. ii.* 330 ; *Eyles, l.c.* 291.

Mountain zone : Vleis : Creeping plant, dorsiventral and dichotomising : Growing over black vlei mud : Mt. Nuza plateau ; July, 1934. No. 506. One of the commonest vlei plants on Mr. Nuza plateau ; Aug., 1934. No. 1262.

30. ***Lycopodium ophioglossoides** Lam. Encycl. iii. (1791) 646.

Mountain zone : Kloof forest of the Nyumkombe valley : Scrambling ephiphyte in deep shade of the fringing forest ; Oct., 1934. No. 875.

Also from the Transvaal : Mist belt forest : Woodbush : A. H. Bunting in Herb. Wits. Univ. No. 20502 : A. E. Grewcock in Herb. Wits. Univ. No. 20503.

31. **Lycopodium verticillatum** Linn. f. Suppl. Syst. Veg. ed. xiii. (1781) 448 ; Sim, l.c. ed. i. 243 ; ed. ii. 325 ; Gepp, l.c. 243 ; Eyles, l.c. 291 ; Burtt Davy, l.c. 96.

Mountain zone : Kloof forest of the Nyumkombe valley : Scrambling epiphyte ; Oct., 1934. No. 874.

(*b*) Selaginellaceae.

32. ***Selaginella abyssinica** Spring. in Mem. Ac. Sci. Brux. xxiv. (1850) 99.

Mountain zone : Kloof forest of Mt. Nuza : In fairly dense shade near a stream ; June, 1934. No. 290.

33. **Selaginella Kraussiana** A. Braun, Ind. Sem. Hort. Berol. (1859) 22 ; Sim, l.c. ed. i. 252 ; ed. ii. 335 ; Gepp, l.c. 244 ; Eyles, l.c. 291 ; Burtt Davy, l.c. 97.

Mountain zone : Kloof forest on Mt. Nuza : In the shade of ferns on a streambank, creeping ; June, 1934. No. 216.

III. EQUISETALES.

(*a*) EQUISETACEAE.

34. **Equisetum ramossissimum** Desf. Flor. Atlant. 2 (1800) 398 ; Sim, ed. i. 240 ; ed. ii. 334 ; Eyles, l.c. 290 ; Burtt Davy, l.c. 95.

muFuti : Riverine vegetation among Narwatsi : Growing on a streambank in the Honde valley ; Nov. 1934.

GYMNOSPERMS

By H. B. GILLILAND.

Gymnosperms in Southern Rhodesia, though present and of good quality, are economically unimportant as yet, since they occur in such small quantity. They are confined to Manicaland, Umtali county and Gazaland on the eastern border. Little sylvicultural research has as yet been prosecuted into their potentialities and naturally so since the investigations proceeding are concerned with the economically important " mahoganies " and " teaks " of the western parts of the country. Their geographical limitation to the eastern border zone of high rainfall and humidity is interesting and suggests a relict—as does their ecological behaviour—from past greater prominence and wider distribution. A record from the Umvukwe hills would go far to substantiate this suggestion. The interesting record, made by Dr. Galpin, of the occurrence of Podocarpus to the south-west in the mountains west of Nylstroom has been commented upon elsewhere. (Gilliland 1938*b*.)

Three genera, with one species each, are represented.

CYCADACEAE.

Encephalartos gratus Prain, var. **manikensis** Gilliland, var. nov.

A typo, foliolis brevioribus, strobile maris fere sessile, tomento floccoso absente, facillime distinguenda.

Plant from 3—8 ft. tall with, in the female a short stem of 4—10 in. height and 1 ft. diameter, in the male a stem of 3—4 ft. and 1 ft. diameter, both covered with remnants of leaf bases and scales. Leaves, pinnate, with ± 60 pairs of pinnae, narrowly ovate-lanceolate in outline, 3—4 ft.

long. Petiole and rachis sub-cylindric, glabrous in specimens seen. Pinnae, lower, much reduced, lanceolate to triangular-acute, $\frac{3}{4} \times \frac{1}{2}$ in. with 1—2 sharp diverging spines above and below and a spiny tip; middle, 5—6 ins. $\times \frac{3}{4}$—1 in., lanceolate-ovate, sub-arcuate, ending in a forwardly directed spine and with one or two diverging spines on the upper and lower side; upper, narrow lanceolate-arcuate, entire or frequently with one or two diverging spines on the upper or lower edge, sharp pointed. Male cone, on a short peduncle, 1—$1\frac{1}{2}$ ins., and glabrous, 9 ins.—1 ft. tall by 3—4 ins. broad at the base, tapering to a rounded apex. Scales numerous, spirally arranged, with a flattened, rhomboid, slightly recurved tip, ridged, but not umbonate. Female cone not seen. Seeds, without the fleshy coats, 1—$1\frac{1}{2}$ ins. by $\frac{1}{2}$—$\frac{3}{4}$ in., ovoid.

Seedling leaves much shorter, with more oblong, smaller leaflets and many spiny teeth forming a multi-spinose, blunt tip. Gilliland, No. 2016. In muJanje in the Numkwarara valley in muTsatsa zone. Dominant in the xerosere on Gorongowe at 4,500 ft. Plant of 1—4 ft. July, 1937. muTete of chiManyika. (Plates 43 and 44.)

Prain in Flora of Tropical Africa, VI, ii. (1917) 346, Stapf & Burtt Davy in the Manual of Flowering Plants and Ferns of the Transvaal, i. (1926) 98 and Hutchinson and Rattray in Flora Capensis, V., ii. (1933) 28, have given accounts of the Cycads of the areas surrounding Manicaland. From these it is apparent that our plant belongs to that closely related group containing *E. Hildebrandtii*, *E. gratus*, *E. Woodii*, *E. Altensteinii* and *E. transvenosus*. Considering the close relationship of these species and the frequent difficulties they present we thought it best to give our plant varietal rather than specific rank till more is known about them.

Rumours of a Cycad on the eastern border of Rhodesia reached my ears early in 1934 and, a year later, while in the Numkwarara valley superintending locust destruction, I became convinced of the existence of a Cycad on the slopes of Mt. Gorongowe from the description of the "muTete" given by my boys. Unable at that time to investigate further I nevertheless decided when opportunity offered, to make a further search. So that in July, 1937, when traversing the valley with the Witwatersrand University Botanical Expedition, I detailed two students, Messrs. H. Janse van Rensburg and I. L. Johnston, to cross the river and climb the slopes of the mountain. They rejoined us at nightfall with some leaves, male cones, young plants and seeds as well as with some excellent photographs of an *Encephalartos*.

On the lower slope of the mountain the plant grows in *Uapaca* and *Brachystegia* woodland, while higher up it becomes the dominant on the rocky mountain slopes. It fruits, according to the natives, in the

rains (December—January). At any rate all that my young friends could find by diligent search round the base of female plants were some old seeds from which all trace of succulent coats had been removed. The males appear to be more numerous than the females and seedlings are scattered.

Swynnerton in his account of Gazaland makes no mention of a Cycad and my own observations in that region disclosed no sign of specimens. Perhaps some may eventually be found on the Chimanimani mountains or on the eastern slopes of Mt. Inyangani. The plant is the same, I think, as the specimen I collected in 1935 on the rocks at the edge of the forest on the summit of Mt. Garuso in Portuguese East Africa, which is, in all probability, that referred to by Sim. (1909).

TAXACEAE.

Podocarpus milanjianus Rendle in Trans. Linn. Soc. ser. II., iv. (1894) 61 ; Jour. Linn. Soc. Bot. xl. (1911) 235 ; Eyles, Trans. Roy. Soc. S.-Afr. v. (1916) 292 ; Stapf, Flor. Trop. Afr. vi. 2 (1917) 340 ; Dallimore and Jackson " Handbook of the Coniferae " ed. ii. (1931) 50 ; " Conifers in Cultivation " Roy. Hort. Soc. (1932) 281.

This Central African " Yellow wood " has a wide distribution, from Kenya in the north to the Chimanimani mountains in Gazaland. It is perhaps at its best in the Usambara Mts. and on Mt. Kenia, where it reaches a height of 100 ft. Although in the Chimanimani reaching a height of 40 ft. with 2 ft. diameter, in Manicaland no such specimens occur. It was observed, in fact, only in one locality on the south east corner of Stapleford Forest Reserve in the valley of the Nyumkombe. Here as a small fruiting tree it reaches a height of 25—30 ft. with an 8 in. trunk and occurs as a sapling of scarcely 2 in. diameter. On the southern slope of the valley in the chiNyamariro forest patch one specimen reaches 60 ft. in height with an 8 in. trunk. (Plate 45, fig. 1.) All specimens noted, except the fruiting tree, were in dense shade under canopy.

Gardner in " Conifers in Cultivation " p. 283 notes that the fruit is " a fleshy aril-like body, bright red when ripe, on the top of which grow two smaller green, soft coated seeds." In my specimens both the " aril " and seeds were a dark blue-purple and covered with a glaucous bloom.

A tree confined, in Manicaland, to the mountain forest zone.

CUPRESSACEAE.

Widdringtonia Whytei Rendle, l.c. t. 9, f. 6-11 ; Jour. Linn. Soc. xl. (1911) 235 ; Sim, For. Flor. Port. East Afr. (1909) 109 ; Eyles, l.c. 292 in syn. ; Stapf, Flor. Trop. Afr. vi. ii. (1917) 334 ; Flor. Cap. v. ii. (1933)

17 ; Burtt Davy, Man. Fl. Plts. & Ferns. Transvaal, i. (1928) 102 ; Dallimore and Jackson, l.c. 541.

W. Mahoni Masters. Jour. Linn. Soc., xxxvii. (1905) 271 ; Sim, l.c. 109.

Callitris Mahoni (Mast.) Engl. Pflanzenwelt Afr. ii. 88.

C. Whytei (Rendle) Engl. l.c. 89 ; Eyles, l.c. 292.

(Plate 45, figs. 2 and 3.)

The general opinion of the Milanje Cedar is that it is one of the most useful of all coniferous timbers. The requisite sylvicultural technique for its exploitation in Rhodesia has, however, proved elusive for although Mr. Swynnerton met with some success in the early days of the century, it has not proved very successful at Stapleford. The tree is at its best in nature on Mt. Milanje where it reaches a height of 120 ft. with a good straight bole but it seems to become dwarfed in more southerly latitudes. The best grown specimen noted in Manicaland was scarcely 50 ft. tall and in the Northern Transvaal it rarely exceeds 8 ft. though fruiting profusely. With the exception of some few isolated specimens noted in a kloof near Melsetter in *Brachystegia* woodland all these are, like the last, plants of the mountain forest zone.

The tree thrives in the milder parts of Great Britain being thus recorded from Cornwall and Rosshire.

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PLATE 41. Tree trunks and branches in the chiNyamariro Forest, Rhodesian Manicaland, showing typical Bryophyte habitat of the mountain zone of that area.

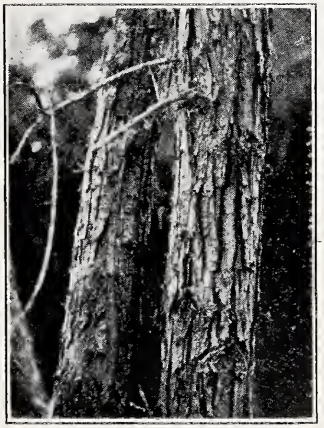
PLATE 42. a. *Cyathea Deckenii*, Kuhn. Growing along the streambed in Ziwani Forest, Imbesa Estate; Penhalonga. The late Mr. H. Kleinschmidt, Forest Officer to the British South Africa Company, in the foreground.
b. (Inset, right). Part of the stem of a specimen at a height of 5 ft., showing the emergence of a prop-root.

PLATE 43. *Encephalartos gratus* Prain. var. *manikensis* Gilliland, in Uapaca savannah on the slopes of Mt. Gorongowe, S. Rhodesia.

PLATE 44. FIG. 1. *E. gratus* var. *manikensis* showing male cone in amongst terminal rosette of leaves.

FIG. 2. *E. gratus* var. *manikensis*. Leaves and male cones.

1



2

3

PLATE 45. FIG. 1. *Podocarpus milanjianus* in chiNyamariro forest, S. Rhodesia.
FIG. 2. Bark of *Widdringtonia Whytei*.
FIG. 3. Clump of *Widdringtonia Whytei* north east of Mt. Nuza, S. Rhodesia.

REVIEWS AND ABSTRACTS.

Report of the Fourth International Grassland Conference: Great Britain. 1937. pp. xxxiv and 486. 40s.

A distinguished botanist has made the remark that the whole of man's existence and progress depends upon grass. Some notion of the essential truth of this statement can be got from a perusal of this imposing volume which further bears striking testimony to the real value of botanical science for the practical affairs of life.

Though only one of the applications of botany is dealt with that one is fully covered, and this report is that of the fourth international congress on this subject. This 1937 conference was held at Aberystwyth under the presidency of Professor Stapledon and was attended by representatives from no less than 37 different countries.

The report of proceedings is arranged under six sections together with contributions of a general character that were given at plenary sessions. The last include the presidential address and a striking paper on pasture management in relation to the control of soil erosion. Out of the wealth of material it is perhaps invidious to select individual contributions but of special interest and importance to South Africans are some in the section of Grassland Ecology, such as a paper by J. W. Rowland on factors affecting range management in this country and one by W. R. Chapline on the restoration of range lands in America. Both of these deal with problems of importance to every grassland farmer. Practically every aspect of grassland is dealt with:—management, treatment, hay production and grass drying, soils and soil treatment, artificial pastures, and many others.

Indeed this report is one that deserves the study of all who are interested in the agricultural welfare of the country.

The papers are in English or in German; those in either language have an abstract in the other. The general reports are given in both languages.

R.S.A.

Erosion and Soil Conservation, by G. V. Jacks and R. O. Whyte. Herbage Publicn. Series. Bulletin 25. Imperial Bureau of Pasture and Forage Crops. Aberystwyth. 1938. pp. 206. 5s.

The evil of soil erosion and the problem of soil conservation are now recognised as both widespread and of vital importance for the future of the world. Loss of soil with all its attendant evils is occurring in all countries which experience a seasonal distribution of rainfall. Though the evils are not new ones, at the present time they are probably greater than at any time in history. It is now held with a good deal of confidence that the decay and disappearance of older civilisations can be attributed to loss of soil.

The present bulletin is a compilation that makes an attempt to bring together what is known from a great number of countries of soil erosion and what steps are being taken for conservation. It does not in any way profess

to originality nor does it set out to inculcate any specific views. The accounts of the various countries are based on official reports and on scientific papers. Throughout the editors have maintained an attitude completely impersonal.

The general effect of reading the bulletin is one of depression at the short-sighted and careless destruction of vegetation that has given the start to erosion. The same story is repeated in country after country, destruction of forest, overgrazing, careless cultivation, followed inevitably by erosion with its insidious ever-increasing effects.

That the world is awakening even if slowly to the facts is apparent in the publication of this volume and is a hopeful sign, but even a cursory study of the reports demonstrates that immediate reorganisation of methods on a large scale and often with great accompanying expense is needed to check and combat the progress of soil erosion. The alternative is loss of soil and the production in the very near future of useless sterile desert areas with results of the most obviously serious nature for mankind.

Of the various countries the most full account is that on the United States of America. The problem is very serious there undoubtedly but more than any other country the U.S.A. has realised the magnitude of the evil and taken steps towards conservation on a truly national scale.

The section dealing with South Africa is divided into two parts, the one on the country as a whole, the other dealing with the special problems of the native reserves. The summary given shows that measures are being taken to combat the evils. There is apparent, however, a tendency to deal with local areas individually rather than to put forward a national conservation scheme. The seriousness of the position in this country was fully brought out in the Report of the Drought Investigation Commission published in 1923. Perhaps the reaction that is now taking place is as rapid as can be expected but a continuation of such complacent dilatoriness must lead to losses of incalculable amount.

It is to be hoped that this bulletin which is issued at an exceedingly moderate figure will have a wide publicity. The calm presentation of the facts is in itself a warning that should be taken heed of by everyone with any interest in the land. R.S.A.

Progress Report on Soil Erosion and Grassland Experiments. University of Pretoria. Grassland Research Committee. 1937.

This report comprises 112 duplicated pages of results of experiments carried on in 1936-37. Twenty-seven different experiments are in progress and together cover a wide range of aspects of the problems. The general scheme of experiments might well serve as a model to others. The ultimate results of the experiments when brought together should be of great interest and importance. This report consists mainly of tables of figures which will be useful for reference. R.S.A.

Municipal Parks ; Layout, Management and Administration, by W. W. Pettigrew, V.M.H. ; Journal of Park Administration. London. (23s. in S. Africa.)

The profession of Public Gardener is one which has only of recent years struggled to general recognition, and many plant lovers have been interestedly awaiting the first monograph on the art from the practical point of view.

Books on gardening and garden architecture are legion, but this, we think, is the first to state plainly the function and work of a municipal superintendent of parks.

To the majority of amateurs this will come as a surprise for, as the title indicates, it is primarily a treatise on administration. Those who seek here the secrets of mass floriculture, of park-tree growing and the thousand and one things that our public parks seem to be able to do so much better than the amateur, will seek in vain.

" Preparing and Reporting on a Scheme for Layout of Land as a Public Park " ; the oft repeated " Estimates of Costs of Labour and Materials " ; " The Bye-Laws and Their Application " ; " Personnel of the Office Staff and Allocation of Duties " ; " Office Routine," to select only a few of the twenty-seven chapter headings, give a clear idea of the scope of the work, while the appendix on the different types of form usable in a parks department lends further weight to the administrative emphasis.

We of the Biritish Empire have been apt to take our administration all too traditionally and to leave the young man to learn from bitter experience. Thus, human nature being much the same in all professions, this treatise should prove valuable to many besides those for whom it is primarily intended. There are few sources, other than the somewhat rigid discipline and tradition of the fighting services, whence so clear an exposition of how to administer can be found.

Of more general interest are chapters and sections dealing with horticultural education—horticulture in its public not orcharding sense—education of the public and botanic gardens ; and wild and bird life sanctuaries.

We in South Africa, thanks to the initiative of our Park Superintendents' Association, have now a recognised course leading to a National Diploma in Horticulture, but as yet we have few botanic gardens, other than those of Kirstenbosch and Durban, of any note. And, though our Game Reserves may be world famous, the smaller wild and bird life sanctuary seems scarcely to have reached the cognisance of most of our municipalities.

One feature of the work which, while we recognise its value to the health and happiness of the community as a whole, may cause some shadow of regret, is the evident greater stress laid in these times on playgrounds, for young and old alike, and the relegation of the purely aesthetic to a place of more secondary importance.

This book, we feel sure, will find a ready home on the shelves of all interested in Municipal Government and we congratulate Mr. Pettigrew on drawing so clear a picture of a Parks Department at work. H.B.G.

The "Critica Botanica" of Linnaeus. Translated by the late Sir Arthur Hort, revised by Miss M. L. Green, with an Introduction by Sir Arthur W. Hill. London. Bernard Quaritch, printed for the Ray Society. 1938. Price 12s. 6d.

The Ray Society has done botany a signal service by publishing an excellent translation of this important work by Linnaeus, prepared by the late Sir Arthur Hort. As Sir Arthur Hill points out in the introduction it is a sad reflection on the present day that such a translation should be necessary. In the days of Linnaeus Latin was the *lingua franca* among all scientific men.

To-day there are few botanists who are completely at home in this tongue, consequently the works of Linnaeus, apart from the ones dealing with his system of classification, are less well known than they deserve to be.

The Critica Botanica is an interesting work from the point of view either of its historic value or of the penetrating remarks of its author on the principles of systematic botany. In 1737, the date of the publication of this work, utter confusion reigned among botanists with regard to the naming of plants. The same plant was given different names by various authorities and there was no guidance as to which of these names was the correct one. In this work Linnaeus lays down definite rules with regard to both generic and specific names. It is important to bear in mind that at this time the binary system of nomenclature adopted by Linnaeus at a later date was not established, and the specific name was frequently a phrase intended to be a diagnosis of the species. Consequently Linnaeus objected to such procedure as the inclusion of the name of the discoverer or any other person as part of the specific name. Later on when the specific name lost its diagnostic character and became merely a term of reference, many of the objections sustained here ceased to have any significance. Thus in the Species Plantarum, published in 1753, we find Linnaeus giving specific names, many of which are directly opposed to the rules laid down in this present work.

Some of the lines have a surprisingly modern air. In discussing what constitutes a good species Linnaeus states : " the botanist who has been more accustomed to handle herbarium specimens than living plants, fancies that the smallest difference is the mark of a distinct species. . . . Again those who only cultivate plants in gardens where they often undergo variation, commonly believe that they possess more species than they really have unless they take the pains to study the plants in the wild state." These words could only have been written by a man whose knowledge of plants was based on a wide experience. They are as true to-day as they were two hundred years ago. This work leaves an impression of a great man in whom sound common sense was allied to an acute and orderly mind, and we are grateful for this attractive translation which renders the Critica Botanica accessible to any botanist. It is well worth careful study. M.R.L.

The Naming of Plants, by Vera Higgins, M.A. Edward Arnold. 4s. in South Africa.

The author, who is well known for her work in editing *The Bulletin of the Alpine Garden Society* and *The Cactus Journal*, has here attempted that most difficult task—the exposition of a scientific technicality in a popular way. And she has so far succeeded that the remark on the wrapper " The Book for Every Gardener " can be heartily endorsed. Indeed, we feel that many a professional botanist will profit in understanding through reading these pages.

By way of introduction the book discusses the history of plant naming and speaks in very readable fashion of those plant characteristics found most useful in the business of classifying.

We are then taken through the intricacies of the international rules of nomenclature both from the botanical point of view and from the point of view of those which have resulted from the Horticultural Congresses of London, Paris and Rome, in a very straightforward way.

The chapter on " Practical Applications " that follows is both interesting and sensible and we feel sure that most of us will be ready to put many of the suggestions into practice. Much confusion in plant naming can be saved along these lines.

Throughout the book there is some hint of a developing antipathy between the gardener and the botanist which we are fortunately able to aver has not appeared in South Africa. This timely publication will, we feel sure, do much to prevent its coming in the future. H.B.G.

The Vegetation of South Africa, by R. S. Adamson, M.A., D.Sc., British Empire Vegetation Committee. London. 1938. 10s.

This is at once one of the most interesting and intriguing books that we have read. In turning the last page we put it down with a keen sense of indebtedness to the author. A generous account of South African vegetation, such as this, has long been needed. If, all too often, our interest is brought to a point where the fact that we do not know enough to proceed further breeds exasperation, surely it is a book that will prove a source of inspiration to research to those younger of us, students of Africa's vegetation.

In a disarming preface Professor Adamson expects criticism from students of other areas than the Cape. This would be easy on points of minor detail but in the broad picture there is not much at which we would cavil except perhaps in the interpretation of the grassland vegetation. Here we think the author follows the earlier work too literally. Certainly the interpretation of *Themeda* as climax in the Transvaal, over much of the Free State and a large protion of Natal would find little support from more northerly investigators. Some statements concerning forest and forest types we feel might also meet with the criticism of those who have spent several years investigating them.

The chapters on physiography, climate and weather, geology and soils present a condensed and precise account that should be particularly useful, while interesting data are presented, particularly in the summary of regional climates on page 56, where these are worked out in relation to regions defined by vegetation type. In dealing with soils we note with some surprise the omission of termites when attention is drawn to the absence of earthworms as a general rule, while reference to a supposed absence of a humus layer in montane forest is also interesting.

The chapter on ecological factors and vegetation is again a useful summary of our knowledge of the problem ; the account of our knowledge of biotic factors being in itself a useful indication of how little we know of the interrelationships of non-domesticated animals and the vegetation.

Bush, forest, savanna, grassland and semi-arid vegetation are again usefully summarised in special chapters. The nomenclature of the different stages is perhaps somewhat unequally treated. We find difficulty in understanding precisely what is meant by the term climax and it is manifest that we do not know sufficient to attempt the more subtle distinctions of climax suggested by Clements. The fact that *Themeda* is no longer regarded as important in the grassland vegetation—its grassland nature being in fact questioned—has already been alluded to.

An interesting chapter is devoted to land utilisation and natural products and again forms a very valuable summary though we question whether data

presented on annual mining returns are altogether necessary to an account of the vegetation.

" General Conclusions and Prospects " form very interesting reading. Certain major conclusions appear to be new and thoroughly sound. Chief of these is the recognition of the essential unity of the East African vegetation, in its widest sense, from far in the north to the Cape. Three other large units are recognised. Kalahari Vegetation ; Namib Vegetation and Southern African. This last, it is pointed out, has affinities with the East African.

" The Comparison with Other Regions " is instructive and the section devoted to " Natural and Political Boundaries " shows the unreality of present boundaries and the essential naturalness of Rhodes' large view.

We feel that the conclusion of the section devoted to " Changes in Climate " that " the flora has reached a state of equilibrium " may not be generally accepted.

Much of the final section on " Changes in Vegetation " and " Prospects " will meet, we feel sure, with the wholehearted support of South African field workers and we hope that this account, in hands of government power, may result in increased impetus to that work designed to prevent apparently inevitable destruction of our natural resources. H.B.G.

INDEX TO PLANT NAMES.